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THE IMPORTANCE OF TEXTURE IN SOILS.

LOOSE AND CLOSE SOILS COMPARED.

B. C. ASTON, F.N.Z.Inst., Chemist to the Department of Agriculture.

SPEAKING generally, the two great factors which between them determine the fertility of soils are climate and the texture of the soil. Texture is a convenient term to denote the relative fineness of the particles which make up the soil.

Climate determines the amount of water which falls on the soil, and texture is responsible for the length of time such water is retained. The texture may be either too loose or too close. An example of a loose type are the coastal dune sands, containing some 95 per cent. of sand, where water does not lie. An example of a close type is a soil which contains such an excess of clay particles that it can be worked only when at a certain optimum content of water, and which is liable to puddle in wet weather and to parch and crack in droughty seasons. In between these two extremes lie the great majority of fertile soils, containing such a proportion of fine and coarse particles and clay that each kind contributes something of its quality to the resultant mixture and mitigates the effect of any one group of particles.

The results were published in last month's *Journal* of mechanical analyses of Rotorua County soils. The present article serves to throw some further light on these.

The mineral particles comprising a soil are separable into three classes—sands, silts, and clay. The distinction between them in the case of sands and silts is not so clear as between these and the clay particles. What is meant by "sand" hardly requires explanation. The example given of the dune sands is a very good one. Silts are really finely ground sands, but the finer grade of silt possesses some of the characters of clays in the tendency to cake together and also to block up the interstices of the soil. Clay particles, on the other hand, are somewhat sharply separated from the other mineral particles. There is no grittiness in their texture. When dry they expand with water, and on drying they contract. If the drying is pushed further and a red heat applied the nature of the clay is completely changed

and cannot be restored by rewetting. It is the proportions of sand, silt, and clay that determine whether a soil is termed light or heavy, dry or wet, easy or difficult to work, and whether it responds best to quicklime or carbonate of lime or to organic manuring; also, the climate being unchanged, whether crops grown are early or late.

A few lines may be devoted to a description of these three kinds of soil particles, which are further subdivided in the case of sands and silts into fine and coarse fractions.

Clay is perhaps the most important mineral constituent of the soil in its influence on soil-fertility. It is what is called a plastic colloid, but it exhibits its properties only if an amount of water is present. When rubbed with water it puddles and makes a substance impervious to water or air. It is smallest of all the soil particles, and has the effect of binding the soil together and of increasing the water-holding capacity.

If only a little clay is present the soil has so little power of retaining water that the plant is dependent on a regular rainfall or on an underground supply of water near the surface. This is what happens in most places in Rotorua County. The soil contains so little clay that the water quickly runs through it. Were it not for the high and well-distributed rainfall, or the closeness of the water-table in the area adjoining the Lake, all the ills which follow a droughty condition of the soil would result. In the absence of a favourable water-supply, sandy soils in the south part of England containing less than 4 per cent. of clay are barren and uncultivated, and it is not until the amount of clay reaches 10 to 14 per cent. that satisfactory results are obtained.

Larger amounts of clay have too great a binding effect and must be counteracted by coarse sand, stable or other organic manure, or by liming. With too much clay—say, 40 to 50 per cent.—the land becomes so tenacious that under English climatic conditions it is abandoned to pasture. Clay is the substance which contributes the gelatinous effect to soils, and when shaken with pure water the clay particles are so constituted that they may remain suspended for months.

Clay makes a soil more difficult to till, but limestone or quicklime—either of which is converted ultimately into bicarbonate of lime in the soil—corrects the ill effects of the clay by flocculating it—that is, causing the minute particles to separate into flocks.

The presence of the optimum amount of clay in a soil is useful not only in hindering the leaching away of those plant-foods which are liable to be so lost, but clay particles actually combine with or “fix” the ammonia and potash of the salts of these bases when applied as manure—a very valuable function.

The silt fractions have some of the properties of clay in increasing the water-holding capacity of the soil and making it more difficult to work, especially if much clay is also present. Silt particles, however, quickly subside when agitated with water. Silts differ from clays in the fact that where their proportion is ill balanced and the land is intractable they cannot, under English conditions, according to Hall and Russell, be ameliorated by lime treatment. In New Zealand very great areas of silts are found in the South Island, both in the Westland and the Otago Central districts—the mica-schist silts. These do

respond to liming, but it is not plain whether this is due to chemical or to mechanical improvement. Some silty soils cake together tenaciously after rain on the surface, and their treatment presents special problems which do not confront the tiller of the more common types of soil. It will be seen that in the Rotorua County soils the silts are present in amounts greater than the clay fraction—an unusual combination. The presence of such an amount of silt is probably highly beneficial in the absence of clay, which is present only in amount of the order of 1 or 2 per cent.

Fine sand is present in all, and forms a considerable proportion of most soils. It has not so great an effect as silt in maintaining a good moist condition; caking of the surface takes place sometimes with fine sands as with silts. Some fine sands, owing to excessive porosity, are notoriously infertile when much fine sand is present and clay lacking.

Coarse sand is said to be the most variable mineral fraction of the soil. It is in its action the reverse of clay, and therefore exercises a great effect in the general fertility, keeping the soil open and friable, facilitating tillage, and increasing drainage and evaporation. For English climatic conditions it has been laid down that a soil containing 40 per cent. or more of coarse sand and less than 5 per cent. of clay is tillable only where large quantities of dung are available or where the water-supply is exceptionally good. As the supply of coarse sand increases, one arrives finally at the conditions presented by the dune sands, characterized by extreme mobility and deficient water-holding capacity, therefore liability to drought and to undue leaching away of any nitrogenous manure or lime applied. Such sands can be improved only by claying, or by green-manuring or its equivalent—that is, some method of increasing the organic matter present.

It will be seen in the analyses published that many of the Rotorua soils contain more than 40 per cent. of coarse sand, but the sand is of the porous pumiceous character, and the rainfall of the district much greater and better distributed than that of many temperate countries. Moreover, the chemical composition of the particles is entirely different from that of the sands common in England. Hence there are three good reasons why no unduly pessimistic view should be taken of the pumice soils in question. Further, the sandy particles will in time, with tillage and the resulting compaction and the incorporation of organic matter, decompose into a substance tending towards that clay which would be the salvation of all these lands were it economically possible to apply it.

A SOIL-DETERMINATION CHART.

By the aid of the accompanying chart (which is adapted from a paper by A. Nostitz, Munich) it is possible to obtain a diagrammatic view of the probable fertility of a soil when judged by its mechanical composition, after first calculating the mineral constituents of the soil in percentages—that is, after eliminating all water and organic matter. Where the humus or organic matter of the soil is not present in sufficient proportion to influence greatly the net effect of all the mineral particles the diagram may prove useful in assisting one to come to a decision as to a soil's probable fertility. Where sufficient organic

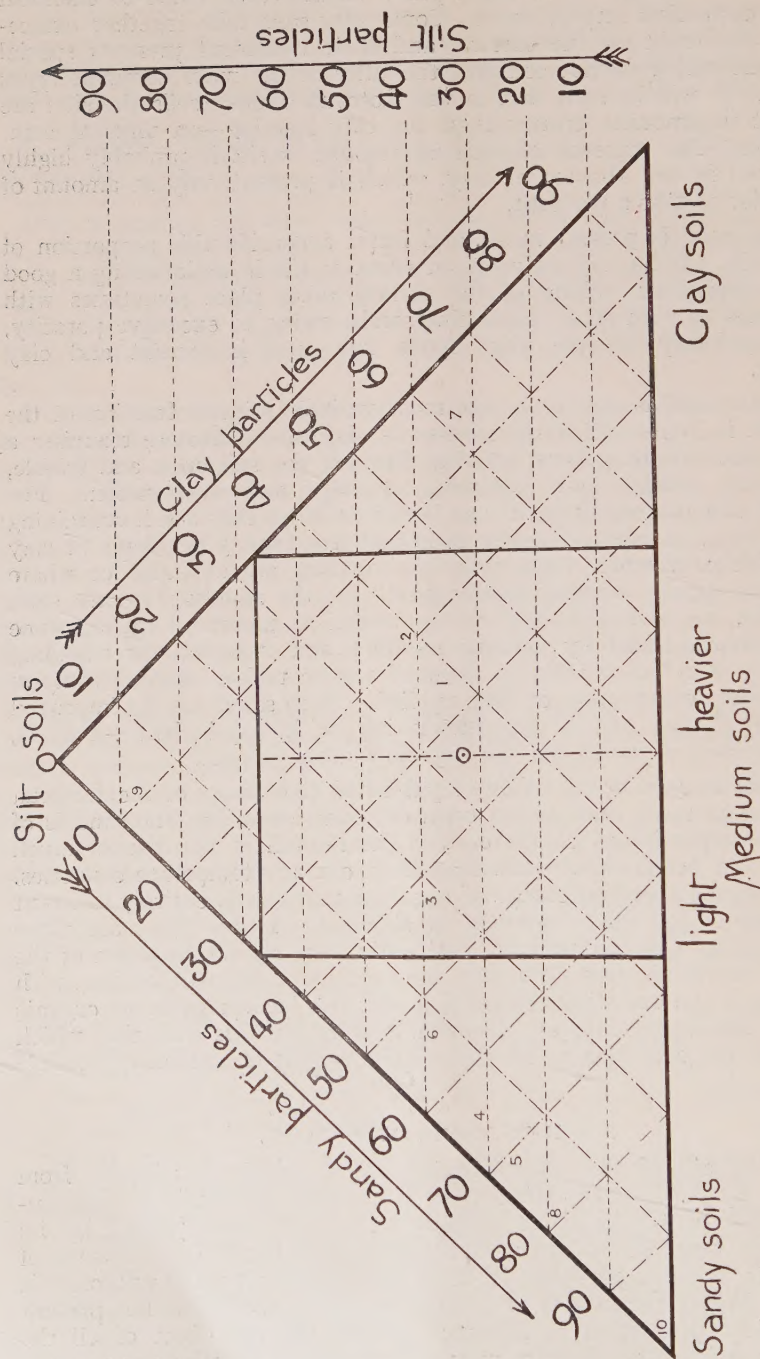


CHART EXPLAINING INFLUENCE OF DIFFERENTLY SIZED SOIL PARTICLES IN FORMING AVERAGE FERTILE SOILS.
For key to soils represented by small figures see opposite page.

matter is present it obliterates all distinctions conferred by the mineral portions of the soil.

By following the lines of the triangle one may pick out the position of any soil the composition of which is given. In the centre of the triangle is a square figure within which all normal soils should fall. Divided by a vertical line, the square figure shows on the left side the lighter and on the right side the heavier soils. As one approaches the vertical line the nearer one gets to physical perfection; as one recedes from it the nearer one approaches sterility, due on the one side to lack of water-holding power and on the other to excessive water-holding power of the soil. At either end of the base line of the triangle one arrives at soils barren from properties which are opposite in their cause. Thus at the extreme left one finds a soil with 100 per cent. of sand, which should be barren owing to porosity, excessive aeration, mobility, and lack of water-holding power—therefore droughty, allowing water to run away rapidly, carrying nitrogenous plant-food and lime, and impossible of cultivation owing to the ease with which wind will transport the particles. At the other end of the line is a soil with 100 per cent. of clay, which would give conditions conducive to sterility owing to excessive tenacity of the soil and the difficulty of working it or of getting fertilizer incorporated.

The sovereign remedy for excess on the left-hand side (the sands) is organic matter, and on the right-hand side (the clays) is quicklime. What is the cure for excessive silt must be determined by a practical test of either or both of the foregoing, remembering the dictum that organic matter will obliterate all distinctions conferred by mineral matters.

Only a few examples of known New Zealand soils are given as examples in the chart, so as not to make the matter too difficult to follow. The Ngawaro coarse sand, the Te Pu coarse sandy silt, the Mamaku sandy silt, and the Oturoa loam all fall outside the square, but as they approach it they improve in quality, judged by their known fertility. They may therefore be classed as extreme types of soils. Within the square are placed three soils from Te Kauwhata (mid-Waikato), which represent the heavier and lighter medium soils the agricultural value of which is undoubted. On the extreme right of the triangle is placed a clay soil, and in the extreme top a river-silt from Poverty Bay. At the extreme left of the base are placed the dune sands of the Wellington west coast. The three extreme types of mineral soils are thus fully exemplified.

Key to Chart.

Analyses of soils with water and organic matter eliminated.

No.					Sand.	Silt.	Clay.
1.	Clay loam, Te Kauwhata	..	..	..	25	35	40
2.	Clay, Te Kauwhata	..	..	..	20	40	40
3.	Loam, Te Kauwhata	..	..	..	40	40	20
4.	Sandy silt, Mamaku..	..	..	..	65	30	5
5.	Coarse sandy silt, Te Pu	..	..	..	70	25	5
6.	Sandy loam, Oturoa	..	..	..	55	40	5
7.	Clay, Samoa	..	..	..	5	30	65
8.	Coarse sand, Ngawaro	..	..	..	78	20	2
9.	Silt, Poverty Bay	..	..	..	18	80	2
10.	Dune sand, Manawatu	..	..	..	100	..	..

FIELD EXPERIMENTAL METHODS.

PRACTICE OF THE FIELDS DIVISION IN CANTERBURY.

A. W. HUDSON, B.Sc., B.Ag., Instructor in Agriculture, Christchurch.

SINCE April, 1925, a number of articles dealing with experiments the results of which have been subjected to statistical examination have been published in this *Journal* under the names of F. E. Ward and the present writer. In each case the method of conducting the work has been described.

With certain crops in the past season considerable modification of the method has been effected, and the object of this article is to describe these methods, which have given excellent results from the point of view of (1) minimizing the work, (2) increasing the degree of precision, (3) reducing the area occupied by an experiment, and (4) greatly diminishing the distances between compared plots.

The work of the preceding year paved the way to improvement by providing a knowledge of probable errors likely to be associated with the plots of varying sizes and dimensions. Further, some idea of the probable differences between treatments which are likely to result has proved extremely helpful in enabling the number of plots required for measurement of such differences to be decided upon.

In planning each experiment full consideration has been given to the following points:—

- (1.) Probable differences likely to result between compared treatments, and number of plots required arranged accordingly.
- (2.) Arrangement of plots in such a way as to bring compared plots immediately alongside or within a few feet of one another.
- (3.) Arrangement of plots to run in the direction of soil variation (if determinable), and across feedings and finishes.
- (4.) Correct rate of sowing of manures.
- (5.) Uniformity of conditions at time of sowing; when possible, all compared treatments are sown the same day.

CEREAL MANURING EXPERIMENTS.

In order to test the practicability of the use of a small drill for cereal, rape, and turnip manuring, one was borrowed from Lincoln College, and our indebtedness to the Director of that institution is here recorded. The machine proved highly satisfactory, and a similar one was soon procured by this Department. The drill is seen in Fig. 1.

The variation in the rate of running of different fertilizers or mixtures under varying weather conditions is well known to be considerable. Hence, every time a particular fertilizer or mixture is to be sown a preliminary trial to determine the required adjustment is necessary.

Drill Adjustment.

A preliminary trial is carried out by jacking up the wheel of the drill, placing a quantity of the manure to be tried in the box, and turning the wheel through as many rotations as it would make in travelling a distance of 10 chains (Fig. 1). With the drill in use (a seven-coulter machine) 10 chains by one drill-width equals approximately $\frac{1}{16}$ acre. The material running down the tubes is caught on a sheet and weighed to the nearest $\frac{1}{10}$ lb. with a delicate spring balance. The rate of turning of the wheel does not have any appreciable effect on the amount delivered. Each manure to be used is tried in this way, each being cleaned out as far as possible without removal of the feed-stars after the adjustment is found. It is a noteworthy fact that when a free-running manure

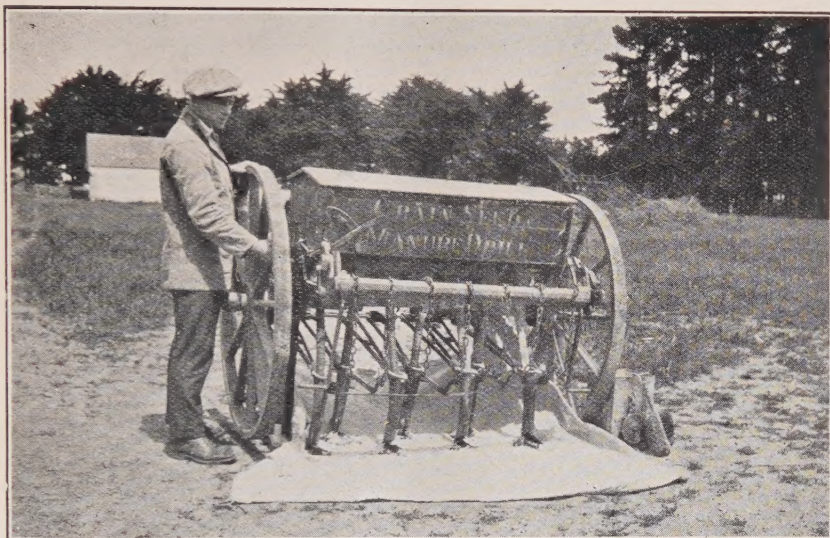


FIG. 1. PRELIMINARY ADJUSTMENT OF DRILL BY JACKING UP AND TURNING WHEEL.

[Photo by F. E. Ward.]

follows one inclined to be "sticky" it will not be delivered at a uniform rate until a distance of about 10 chains or its equivalent in revolutions of the wheel has been traversed. Its rate tends to increase up to a point—apparently until the manure is well run in round the stars. The converse holds when a sticky manure follows a free-running one.

The adjustment obtained as described serves as a good guide for the actual adjustment required in the field. However, before the sowing of plots is carried out a further test of the rate of sowing is made over a measured distance along a headland, or on ground in close proximity to the experimental area. In this case a weighed quantity sufficient to sow the distance traversed, plus enough to keep the stars well covered, is put into the drill—the amount remaining after the trial subtracted from that put into the machine giving the quantity sown.

When experience with mixtures, &c., is gained it is generally possible to procure adjustment with not more than two or three trials. As a further precaution the amount sown in the plots is checked, and does not usually differ from the desired quantity by more than 3 to 5 per cent.

Sowing of Plots.

In order to explain this method it will be assumed that ten replications of treatments are being tried in a particular experiment, and these treatments designated *A*, *b*, *C*, *d*. The drill-coulters are spaced 7 in. apart, and a double space of 14 in. is left between plots; hence the total width of each plot of seven coulters is 4 ft. 8 in.

The treatments are allowed to run in order *A*, *b*, *C*, *d*; *A*, *b*, &c., throughout the experiment. Each plot being 4 ft. 8 in. wide, Plot *A* will fall at intervals of 4 ft. 8 in. by 4, equalling 18 ft. 8 in. To obviate the necessity of frequent cleaning of the manure-box the whole of each treatment is sown before the next is commenced. White-painted sighting-poles about 5 ft. in length, of 1 in. by 1 in. Oregon pine, are placed at intervals of 18 ft. 8 in. along each headland of the experimental area, and where possible a sufficient distance from the "in-and-out" mark (ends of plots) to permit of the turning of the horses without displacing the poles. Intermediate poles are sighted in position, so that with ten replications of a treatment there are ten lines of poles. The driver, sitting in the middle of the drill, keeps himself aligned with the poles while drilling, working up one line and down the next until the whole of the treatment is sown. This operation is shown in Fig. 2. Each line of poles is shifted two plot-widths to one side, and treatment *C* is next drilled in. Blank spaces now alternate with drilled plots. "Filling in" to their allotted spaces now follows with treatments *b* and *d* (Fig. 3).

The object of drilling alternate plots on lines of poles is to ensure uniform spacing. If drilling of Plots *b*, *C*, and *d* followed in order, and a slight and constant error in width of interspace

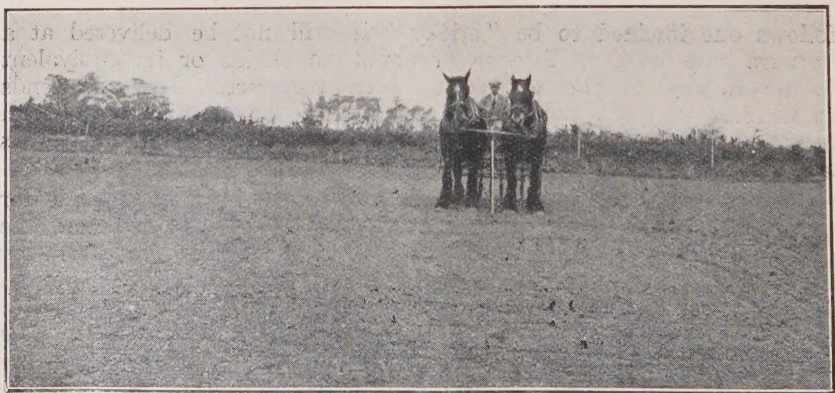


FIG. 2. SOWING PLOTS ON LINES OF SIGHTING-POLES.

[Photo by E. M. Bates.]



FIG. 3. FILLING-IN OF ALTERNATE PLOTS AFTER OTHERS HAVE BEEN DRILLED ON LINES OF SIGHTING-POLES.

[Photo by E. M. Bates.]



FIG. 4. VIEW OF PART OF TYPICAL CEREAL EXPERIMENT, SHOWING THE UNIFORMITY OF SPACING.

[Photo by A. W. Hudson.]

occurred, by the time the whole were drilled the accumulative error would be considerable, and spacing uneven. Fig. 4 shows the appearance of the growing plots.

Harvesting of Plots.

If ripening of the variously treated plots is fairly uniform harvesting is easy, but if differences in ripening occur some difficulties present themselves, which must be overcome by (1) allowing ripe plots to stand until later-maturing ones are ready to harvest (this entails risk with easily shaken cereal varieties); (2) cutting earlier-maturing plots

by hand; (3) sowing extra plots not required for yield-determination. These latter plots allow for passage of the reaper-and-binder, and a certain amount of rolling down is of no consequence.

A uniformly ripening area would be harvested as follows: The cutting-machine is run across both ends of the plots, leaving all of uniform length. If it is desired to divide each into two by a division midway between the ends a cut of the machine is made in the required position. A return cut follows, and a third in the direction of the first. With an ordinary 6 ft. cut this leaves a space 18 ft. wide.

The plots are now ready for cutting out, and each is taken at one cut of the machine. Starting with the reaper clear of material, it proceeds until the 18 ft. division is reached. By the time this is crossed, and just as the machine is about to enter the next section of the plot being cut, a stop is made, and it will be found that all the material which has been reaped will have been delivered on to the

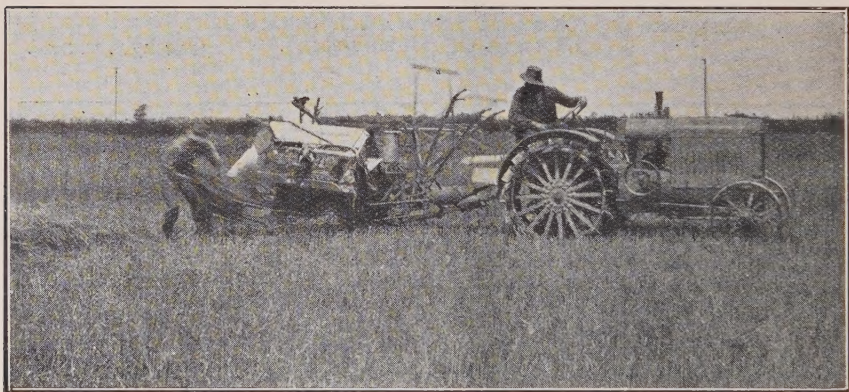


FIG. 5. "RUNNING OUT" THE REAPER-AND-BINDER ON COMPLETION OF A SECTION OF A PLOT AND BEFORE THE CUTTING OF THE NEXT SECTION IS COMMENCED.

Farm of J. Foster, Ladbroke's.

[Photo by F. E. Ward.]

binding-table. The tripper is then pressed down and all the material discharged by rotating the discharge-arms. The cutting of the next section proceeds, and the machine is run some 18 ft. past the end and again cleared.

Without the use of the 18 ft. space, clearing of the machine with the winding-handle is necessary, and this is somewhat laborious. In Fig. 5 a tractor-drawn reaper-and-binder is seen at work, and its use obviates the use of the space required in the case of a horse-drawn machine, owing to the machine being cleared by an independent drive from the tractor.

(It may be mentioned that in the case of variety trials the differences in ripening are considerable, and a specially constructed machine without any side appendages, which would cut its own track, would be ideal.)

Each plot, generally about $\frac{1}{100}$ acre, is labelled and stooked by itself.

Threshing.

This was described in the *Journal* for April, 1925—"Wheat Manurial Tests in Canterbury," Ward and Hudson—to which interested readers are referred.

RAPE AND TURNIP MANURIAL EXPERIMENTS.

The method of drilling manurial trials for rape and turnips is as described for cereals.

Determination of Yields.

Rape: Various methods of cutting have been employed, but none has proved better than that of cutting with a sharp spade. Plots of



FIG. 6. WEIGHING OF RAPE IMMEDIATELY AFTER CUTTING OF PLOT.

[Photo by A. W. Hudson.]

$\frac{1}{2}$ chain by five coulter where sowings are made through every coulters, and by two coulter in the case of 14 in. rows, are cut at ground-level. Thus the outside rows are not taken into account. The cut material is placed in a canvas sheet about 5 ft. 6 in. square and weighed, as shown in Fig. 6, immediately it is cut.

Turnips: Pulling is done by hand or with a light hand-drag, and the turnips weighed in an ordinary grain-sack. Here again outside rows are eliminated, and the length of weighed area is governed by the yield of the heaviest plots. A weight of over 100 lb. becomes difficult to handle, so that a length of plot which will give something a little below this weight is roughly determined before commencing the work on the plots.

Effects of Manures on Germination.

In manurial tests of the preceding year on rape and turnips differences in the number of plants on different treatment were noticeable.

In order to get some idea of this aspect of the manurial treatment germination counts were taken with all cruciferous crops. The method adopted was as follows: A rod 10 ft. in length was taken and dropped indiscriminately on some forty places in the plots of each treatment, the same coulter row being used in every case. The number of plants falling within the 10 ft. length was counted, and the mean and probable error calculated. The counting was done about three weeks to one month after sowing, when all seeds producing plants likely to survive had germinated. Some very valuable and interesting information has resulted, and will be discussed with the publication of results in future issues of the *Journal*.

POTATO MANURIAL EXPERIMENTS.

Up to date only one type of machine has been used for the planting of potatoes with manure. A shallow furrow, in which the manure is deposited, is opened by a moulder in the front of the machine. A second moulder, deepening and dividing the furrow of the first, provides the furrow in which the potatoes are planted. A pair of in-cut disks refill the furrow and cover the potatoes. Thus the manure is slightly mixed with the soil above the seed. Before the sowing of plots a determination of the average width of row is made, and the necessary rate of sowing ascertained by trial over a measured distance. Each treatment consists of six plots, each three rows in width, and the sowing is done in the same manner as that described for the sowing of cereal experiments.

Digging and Sorting.

Digging is done by hand, each plot being divided into a number of $\frac{1}{2}$ -chain lengths. A slanting pole is placed at each end of the middle row of each plot. The middle row is dug first, the side rows then being thrown to the middle (Fig. 7). Each plot is bagged separately (Fig. 8),



FIG. 7. METHOD OF MARKING OUT POTATO PLOTS FOR DIGGERS.

The slanting poles are on the middle row and at the end of a plot $\frac{1}{2}$ chain long.

[Photo by A. W. Hudson.]



FIG 8. POTATOES BAGGED AND BEING LABELLED BEFORE CARTING TO SORTING-MACHINE.



FIG. 9. SORTING AND WEIGHING OF THE VARIOUS GRADES OF POTATOES—
TABLE, SEED, AND SMALL. [Photos by A. W. Hudson.
Farm of W. and A. Campion, Prebbleton.

and labelled prior to carting to the sorting-machine, where the individual plots are graded into table, seed, and small potatoes (Fig. 9).

PASTURE TOP-DRESSING EXPERIMENTS.

The method described in this *Journal* for June, 1925—"Pasture Top-dressing in Canterbury," Ward and Hudson—has not been altered.

COMPARISON OF YIELDS.

Generally comparisons are made between paired plots, and calculations are by "Student's" method as described by Dr. Hilgendorf in his article, "Student's Method of computing Probable Error in Agricultural Experiments," published in this *Journal* for January, 1925.

The number of plots used in the measurement of differences varies with individual experiments, and is generally dependent on the variation met with and the differences resulting between compared treatments. The published results will contain information relative to this and other points.

DOWNY MILDEW OF THE VINE (*Plasmopara viticola*) IN NEW ZEALAND.

THE DISEASE AND ITS TREATMENT.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

AN outbreak of downy mildew—the first recorded in New Zealand—occurred at Henderson and in the surrounding district during the past season. This disease was first brought to the notice of the Horticulture Division by Mr. H. Corban, of Henderson, who brought in a parcel of vine-foliage to the headquarters for identification of an unknown disease. On opening the parcel I recognized an old and familiar enemy, whose acquaintance was made during my residence in the Bordeaux district of France, where downy mildew was a constant source of alarm during the growing season of the vine. Specimens of the vine-leaves were forwarded to the Department's Mycologist, Mr. G. H. Cunningham, who submitted them to microscopical examination and confirmed the result of my superficial examination.

Acting on official instructions, I visited the Henderson district and, working from that centre, inspected the vineyards and vine nurseries on all sides with a view to ascertaining how far the disease had spread. As a result I came to the conclusion that the field of infection was confined within the limits of a line drawn through Swanson on the north, Manukau Harbour and Auckland City on the south, the upper Waitemata Harbour on the east, and the Tasman Sea on the west.

All the vineyards and nurseries inspected in Henderson, Oratia, New Lynn, and Avondale were more or less infected with downy mildew. Most of these vineyards had been sprayed with bordeaux mixture to control black-spot (which is an annual menace to the vine-growers in this district), and had consequently matured their grape crop without much loss. The disease, however, had made headway where spraying had been discontinued owing to the lateness of the season, the leaves and young shoots showing distinct signs of mildew. In only one vineyard of 3 acres were the effects really disastrous. The grape crop in this case was a complete loss, owing probably to the fact that the proprietor, on noticing the symptoms of downy mildew, ceased spraying

with bordeaux mixture and applied colloidal sulphur, which is useless as a control for the fungus in question.

The outbreak of the disease was observed in most of the vineyards late in December or early in January last, and in all cases was first seen in the lower parts of the vineyards, such as at the bottom of a gully, near a creek, or close to a swampy area. All European varieties grown in the district were affected. Albany Surprise was clean in the vineyard, though affected in the nurseries, but even there I did not notice any that had lost their leaves. The Mouvedre $\times$ Rupestris 1202—a popular stock in this district—was affected, and in one nursery the young stocks had lost all their leaves. Incidentally, I believe that this stock could be advantageously replaced as a stock for vines grown on the clay soils of the North by the Riparia $\times$ Rupestris 3306, which is more resistant to phylloxera and mildew, and its affinity for the Vinifera scions is quite as good. Moreover, it causes an early and abundant fructification of fine fruit on the grafted varieties. Cuttings and rooted vines of this variety can be obtained on application to the Manager of the Te Kauwhata Horticultural Station, Te Kauwhata.

In view of the certainty of downy mildew recurring each year in which climatic conditions are favourable in the district already infected, and of its very probable spread to other viticultural areas of the Dominion, a description of the outward symptoms and life-history of the disease will no doubt be acceptable to vine-growers to assist them in recognizing it when seen and in applying the most effective means of control at the most appropriate moment.

Downy mildew is the worst fungous disease European vines are subject to, and is remarkable for the rapidity of its spread. From its original home in the United States of America it was unintentionally introduced into France with American vines, and was recorded there in 1878. Three years later it had spread over the viticultural areas of France, Italy, Greece, and north Africa. A more recent example of the rapidity of its distribution is to be found nearer home. A mild attack was noticed in the Rutherglen district of Victoria in 1917, and in the same district in 1918—the weather being favourable for the development of the disease—90 per cent. of the crop was destroyed.

Owing to the enormous losses caused by downy mildew the life-history and means of combating the fungus in the vineyard have been the subject of much study by botanists and viticulturists in most of the vine-growing countries of the world. The following brief summary is compiled from the writings of some of the more recent investigators, principally from those of Messrs. Vialla, Ravaz, Gregory, Capus, Istvanffi, and Verge, who have rendered considerable service to modern viticulturists by the diffusion of the results of their studies of this and other vine diseases.

THE DISEASE AND ITS EFFECTS.

Downy mildew attacks all the young herbaceous part of the vine, principally the leaves and especially the young leaves, the young green shoots, the flowers, and immature grapes. It develops under the influence of heat and humidity—rain, fogs, or dew followed by sunshine or muggy heat.

The effects of the growth of this fungus can result in the loss of entire crops by causing the non-setting of the flowers, by destroying the grapes in the early stages of their growth, or later rendering them unfit for making good wine. The vines may be wholly or partly stripped of their leaves, which is the most frequent result, the result being that the grapes fail to ripen and the fruiting-wood for the following season does not mature for lack of the food supplied by the leaves in normal seasons. The leaves may be attacked at any period of their growth, but become more resistant with age. Wine made from the grapes of mildewed vines is difficult to keep; it has a disagreeable flavour, and the vinegar-barrel is generally the most suitable place for it.

The visible symptoms are distinct from those of any disease of the vine known in New Zealand. In the early stages light roundish spots are seen on the leaves. Those spots are known as "oil-spots" by the French viticulturist, and this word aptly describes their appearance. From a light-green colour the oil-spots gradually become yellow and finally reddish-brown. They may be isolated or converging, and cover part or the whole of the leaf, in which case the leaf soon perishes and breaks away from its stem.

When humid and warm conditions prevail, efflorescent spots or patches having the appearance of scattered salt develop on the under-side of the leaf and directly under the oil-spots. This "down," from which the name of the disease is taken, can be readily removed by rubbing the finger over it, and the facility with which it is removed distinguishes it from the white spots due to erinose (*Phytopus vitis*), a vine pest which has not yet been reported in New Zealand.

The young green shoots when attacked by downy mildew show spots like those on the leaves, but less easily distinguishable. Later the shoots take on a dark-brown colour and break off with the slightest touch.

In the bunches before or just after the fruit is formed the stalks become black and the flowers or the fruit falls off. If the fungus arrives a little later the berries are covered with a greyish-white down and soon dry up. When larger the berries take on a reddish-brown colour and fail to ripen. The fruit is not safe from the fungus until the berries begin to colour, but the quality of the juice can still be affected by the action of the fungus on the leaves.

LIFE-HISTORY OF PLASMOPARA VITICOLA.

The "down" is only exceptionally seen on the upper surface of the leaves, where it appears alongside the veins. It consists of numerous bush-like growths known in mycology as conidiophores, which are the fructification organs and a continuation of the mycelium or thread-like vegetation of the fungus which develops in the interior of the leaf, where, by means of suckers, it robs the leaf of plant-food and causes the disintegration of the tissue.

The conidiophores grow, in groups of from four to ten, through the stomata or breathing-pores—the majority of which are on the under-side of the vine-leaf—and carry bunches of conidia or summer spores, which when ripe fall on the leaves below or are carried to the herbaceous organs of other vines by the wind. If the conidia happen

to alight in a drop of water, after soaking a while they break up into several segments or zoospores, each of which is furnished with two cilia with which it moves about rapidly in the water. When a stoma or breathing-pore is found it comes to rest and develops a germ-tube, which penetrates by way of the stoma into the interior of the leaf or other organ of the vine. The germination of the conidia under favourable conditions can take place in an hour, and the incubation period within the leaf takes from five to twenty-five days in France, according to the climatic conditions, but generally about seven days, when the oil-spot appears and fructification takes place if sufficient humidity is present in the atmosphere for its development.

It is only during the germination period of the conidia or zoospores that the fungus can be checked. Once the germ has penetrated the tissues of the leaf the incubation and fructification cannot be prevented. It is evident from this that the controlling specific—copper salts, which are easily dissolved by the water on the leaves or other herbaceous parts of the vine—must be there when the spores arrive or immediately after. A very minute quantity suffices to nullify the attack.

Should the germination proceed unchecked another crop of conidia or spores will, under humid conditions, be ready for dispersal in about seven days and so carry on the cycle, which repeats itself under favourable conditions to the end of the season. Dry climatic conditions, or rains followed by drying winds, inhibit the progress of the disease; to continue its life-cycle the fungus cannot dispense with the drop of water.

In case of any doubt as to the nature of oil-spots which do not show any down on their under-surface a simple test may be applied. A few suspected leaves folded in a damp cloth or blotting-paper and placed in a warm atmosphere will, if affected, develop down in about a day's time.

Towards the end of the vegetative season of the vine the usual spots do not appear at the end of the incubation period of the fungus, but in their place a mosaic of different-coloured spots resembling tapestry stitches are seen on the surface of the leaf, and, in the place of the fruiting-organs growing out of the stomata, winter spores or oospores are formed by fusion of the male and female organs in the interior of the leaves. These oospores are protected by a resistant covering which carries them safely through the inclemencies of the winter.

The germination of the oospores from the rotting leaves in the spring depends on their immersion in water in a wet soil or pool, and a temperature of at least 50° F. for a period of not less than twenty-four hours. On this account it is advisable to look out for the first outbreak of the disease in the lower parts of the vineyard near creeks, pools, or other spots where water remains for some time after rain. Gathering the leaves and burning them at the end of the season suggests itself as a method of prevention, but this has not proved effective, nor is it practicable in a large vineyard where the leaves are falling over a long period and get buried or blown into all sorts of corners round the vineyard.

From the germinating winter spore a filament of mycelium or conidiophore grows, terminating in a single conidium resembling the

summer conidium but seven or eight times larger. Inside this conidium are formed a number of small zoospores furnished with cilia, and it is these small spores, or the conidia that contains them, which, when brought into contact with the foliage near the ground, by being splashed or otherwise, cause the first infection.

The area of this first contamination by the winter spores is generally so small that it frequently passes unnoticed. The actual damage done is insignificant; but after the period of incubation in damp weather the efflorescence appears, and summer spores are formed and scattered in countless numbers through the foliage of the vines.

TREATMENT.

During an outbreak of downy mildew in the Gironde, France, in 1882 it was noticed that vines along the roadsides which viticulturists were in the habit of sprinkling with a mixture of sulphate of copper and lime, to prevent pilfering by passers-by, kept their foliage, while the unsprinkled vines lost theirs. This fact induced Millardet and Gayon to study the effects of copper salts, and led to the universal use of the bordeaux mixture as a fungicide to-day. As an indication of the importance of this accidental discovery it is interesting to know that since the works of Millardet and Gayon were published some thirteen hundred authors have written on the subject of copper salts mainly as a fungicide.

It will have become evident to the reader from the foregoing remarks that moisture and heat are essential factors in the germination of the winter and summer spores of downy mildew; that the presence of moisture must coincide with certain phases of the development of the fungus; that winter treatment is useless; and that control can be obtained only by preventive means—the presence of an effective fungicide on the herbaceous part of the vine when the spores arrive there.

To avoid as much as possible the humid conditions which render the progress of the disease possible, vineyards should be planted on well-drained slopes facing the sun, with sufficient protection from the strong gales so prevalent in parts of the Dominion, but sufficiently open to allow the wind to dry the foliage of the vines after rain.

The system of growing the vines on trellis—the most usual method in this country—is a great advantage in the control of fungus diseases, as it permits of a free circulation of air and facilitates the thorough application of fungicides to all parts of the vines. It also makes easier the suppression of excessive development of foliage and growth of weeds between the rows—both forming favourable conditions for the spread of disease, and both exceptionally favoured by the moist climate of some of the viticultural districts in New Zealand. With the aid of the trellis the young growths in the spring can be kept off the ground and to some extent out of reach of the winter spores.

As previously mentioned, the treatment of vines in an infected area to be effective must be of a preventive nature. Owing to the development of the fungus inside the leaf, curative methods are inapplicable.

The fungicide which has received the most universal approval as a control of downy mildew is bordeaux mixture. The strength of the mixture is not of such great importance as the necessity of maintaining a continual supply of the fungicide on the herbaceous parts of the vine, so that the spores arriving in the drop of water find some of the copper salts in solution and are thereby rendered innocuous. Copper salts which remain active during the period of the germination of the spores will control the most severe attack of mildew. Spraying after rain is effective if applied before the germ-tubes have penetrated. Bordeaux which has had time to dry on the foliage resists the washing effects of rain, and releases sufficient copper salt to destroy the spores of the mildew.

While treatments made just before the probable appearance of the disease are of primary importance, the application of bordeaux mixture on the appearance of the characteristic oil-spots—a week after rain followed by a warm temperature—should be proceeded with at once, so as to save the sound foliage. The spray will check the spread of the disease by destroying the fructifications on the under-side of the affected leaves. Young shoots and bunches of flowers and young grapes should be well covered and penetrated with spray. To ensure the adhesion of the spray to the bunches the addition of a spreader is necessary on account of the waxy nature of the surface of these organs. Fresh applications of bordeaux should be made to the newly grown leaves as they appear in seasons favourable to downy mildew while there is still a residue of former treatments on the vines.

In normal seasons applications of bordeaux of $1\frac{1}{2}$ -per-cent. strength, or 2 per cent. in humid seasons (6-4-40 or 8-6-40), should be applied—(1) As soon as possible after the buds break; (2) before the flowers open; (3) when the petals have fallen; (4) fourteen days later, or as required, in seasons favourable to the development of the disease, being careful to keep the young growths covered with spray as they grow.

The first two treatments are of capital importance, and should be applied whatever the condition of the weather. In seasons of intense invasions of downy mildew, or where powdery mildew is expected, the second and third sprayings should be followed, while the vines are still wet with the spray or the morning dew, with a powder composed in the proportion of 7 lb. sublimated or precipitated sulphur, 2 lb. air-slaked lime, and $\frac{3}{4}$ lb. finely powdered sulphate of copper (blue-stone). This should be applied with a sulphur-bellows, hand or knapsack, as when sulphuring for powdery mildew. While the whole of the vine should be sulphured, special attention must be given to the sulphuring of the bunches and fresh growths.

The remainder of the programme must be modified to suit conditions, keeping in mind that neglect to spray in time may mean the loss of the entire crop of the season, and possibly part of the following season's.

The $1\frac{1}{2}$ -per-cent. bordeaux, which will probably be found the most useful in normal seasons (2-per-cent. or even 3-per-cent. strengths may be used during virulent attacks), is made by dissolving sulphate of copper in the proportion of $1\frac{1}{2}$ lb. in 10 gallons (100 lb.) of water, lime being added in sufficient quantity to neutralize the acidity.

An acid bordeaux is more active than a neutral one, but it is liable to burn the foliage. An alkaline mixture is also very effective, but is less adherent than a neutral, which is really slightly alkaline by the time it is applied. A neutral bordeaux is therefore preferred in practice.

The bordeaux can be used up to the time the grapes are picked, and should be used as long as there is any fear of mildew and there is foliage to protect. The salts of copper are said to have a stimulating effect on the leaves of the vine, and we learn from the results of the experiments of Millardet and Gayon that any copper salts carried on the grapes to the fermentation-vat are precipitated in a very short time and carried away in the lees.

PREPARATION OF BORDEAUX MIXTURE.

Viticulturists who are not familiar with the making of the bordeaux mixture will no doubt find a few instructions for its preparation acceptable.

To make 40 gallons of 1½-per-cent. bordeaux—the mixture known in New Zealand as the 6-4-40—take a hogshead, knock one end in, and mark the inside of the barrel at the 20- and 40-gallon levels, ascertained by previously pouring 20 and 40 gallons of water into it. Place 6 lb. of bluestone in a piece of sacking and suspend it in 20 gallons of water till it dissolves; or a quicker method is to spread the bluestone on the bottom of the barrel, pour 4 or 5 gallons of hot water on to it, and when dissolved add sufficient cold water to make up the quantity to 20 gallons.

While the bluestone is dissolving take 4 lb. of freshly burnt lime (more or less lime, according to its degree of purity, may be required) and add water to it, little by little, till it crumbles to a fine powder, to which add 5 or 6 gallons of water. Mix well, and add the resulting "milk of lime" slowly through a sieve or piece of hessian to the dissolved bluestone—never the contrary—stirring the mixture vigorously until just sufficient milk of lime has been added to turn a piece of red litmus paper blue, or a piece of phenolphthalein paper red. Litmus paper can be obtained from any dealer in chemicals for a few pence, and phenolphthalein paper, which is generally preferred for the purpose, can be made by soaking white filter paper or blotting-paper in ¼ oz. (7 grams) of phenolothlein dissolved in half a pint of spirits of wine, using it when dry. Failing these means, the bright blade of a knife or a new nail plunged into the mixture for one minute should not show any deposit of copper if sufficient milk of lime has been added.

When the mixture has been neutralized or is slightly alkaline, add the spreader and sufficient water to bring up the solution to the 40-gallon mark, stirring well to produce an even mixture. Either of the following spreaders may be added to 40 gallons of bordeaux: 4 oz. casein dissolved in 1 gallon water to which 1 lb. washing-soda has been added; or 4 quarts skim-milk; if the milk is sour, neutralize with a little lime or soda. If either of these materials is unobtainable, 3 oz. of dissolved soap can be substituted.

Bordeaux mixture should be prepared as it is required, and used during the day of mixing, as it loses its fungicidal qualities very quickly. Wooden, enamel, or earthenware utensils only should be used in its preparation, owing to the corrosive action of the copper salts.

IMPROVEMENT OF WHEAT AND OATS.

SOME RECENT WORK AT CANTERBURY AGRICULTURAL COLLEGE.

F. W. HILGENDORF, D.Sc., Canterbury Agricultural College, Lincoln.

(1.) Wheat.

THE selection from College Hunter's wheat which goes by the name of "Bell" has been tried against College Hunter's for still another year. The trial consisted of twenty-eight strips of Bell sown beside twenty-eight strips of Hunter's, under exactly the same conditions, and the result was that Bell exceeded Hunter's in yield by 4.6 bushels per acre. This strain was selected in January, 1921, and was merely multiplied for two years. Since then the following results have been attained:—

1923-24: Five field plots—Bell equal to Hunter's. Ten bird-cage plots—Bell beat Hunter's by 12 ± 1.7 per cent.

1924-25: Thirty-six field plots—Bell beat Hunter's by $3\frac{1}{2}$ bushels per acre.

1925-26: Twenty-eight field plots—Bell beat Hunter's by 4.6 bushels per acre. Bird-cage plots—Bell beat Hunter's by 5 bushels per acre in a trial consisting of twenty-four small plots.

This later selection is apparently somewhat better than the original selection that goes under the name of College Hunter's. It has a somewhat denser head, but is otherwise indistinguishable from the Hunter's. Another trial of it is in progress this season, and if it proves satisfactory the strain named Bell will be multiplied for distribution.

Many crosses of New Zealand and foreign wheats are in process of selection at the College, but it is too early to make any report on them. One cross made in 1919 between College Solid-straw Tuscan and College Hunter's has been fixed, and now breeds true to Solid-straw, with strong chaff and high grain quality. About 280 families of the cross are now under yield trial, and are giving every indication of producing a really useful wheat. Millers to whom samples of the grain have been submitted consider it better than either Hunter's or Solid-straw, and one stated that he considered it the best wheat he had ever seen in New Zealand.

(2.) Oats.

In Algerians several strains have been coming on for trial against the strain A86, now known as College Algerians. Twenty-four half-drill strips of each were sown against twenty-four half-drill strips of A86, and the averages gave the following results, the yields being shown in bushels per acre: A86, 73.0 bushels; B49, 75.1 bushels; D4, 71.5 bushels; D17, 71.8 bushels. Strains D4 and D17 have therefore been dropped, but B49 will be given a further trial.

The history of B49 to date has been as follows:—

Harvest of 1921: One of the best ten out of one hundred strains

1922: One of the best four out of these ten.

1923 : No yield trial—multiplication only.

1924 : Five field plots of each of nine strains. B49 was the best of all, A86 coming next.

1925 : Thirty-six half-drill-strip plots were tried against thirty-six of A86. B49 was the better by 7 bushels per acre.

1926 : Twenty-four half-drill strips against twenty-four of A86. B49 was the better by 3.1 bushels per acre.

B49 is therefore a promising strain. It is being given a further trial this year, and a stock of pure seed is being produced for distribution when its superiority to the present College Algerians is finally demonstrated.

In Gartons no success has ever been achieved here, probably because the variety is continually selected by its original producers. Three strains were put under test last year, twenty-four half-drill strips of each being tried against adjacent strips of bought seed. The results were : Commercial beat strain C3 by 2.8 bushels per acre, C12 by 4.5 bushels, and C1 by 2.4 bushels. The strains have therefore been abandoned.

In Duns the strain known as College Duns was tried in a similar elaborate fashion (necessitating the separate sowing, reaping, and threshing of seventy-two different plots) against new strains that had been multiplied sufficiently to put under conclusive test. College Duns beat C15 by 10.5 bushels per acre, C29 by 7.5 bushels, and C12 by 7.5 bushels. The three strains have therefore been abandoned.

In Danish oats only one strain had reached a stage to be tried against the established College strain. The new strain was beaten by 6.3 bushels per acre in a twenty-four-plot half-drill-strip trial.

Summary.

In wheat a new selection bids fair to surpass College Hunter's in yield. The Hunter's-Tuscan crossbreds now at the yield-trial stage promise to produce a wind-resisting wheat of high milling-quality.

In oats a new strain of Algerians is almost certain to excel the present established strain ; but in other varieties the strains at present on the market are better than any of the new selections that have been under trial at the College.

NOTE.—In the foregoing record no figures are quoted that are not statistically significant.

OATS FOR CARRYING FIRE ON BAD BURNS.

THE sowing of oats on a bad burn with the object of securing a good fire over the area when the grain has ripened has been tried with a varying amount of success in several bush districts. The practice opens up great possibilities, for the securing of a hot fire is possibly the main factor in the success of a good grass sward in country tending to secondary growth. Oats or rye-corn would be the most suitable for the purpose in question. A bulky oat which tillers well, such as Black Tartarians, should be sown at the rate of 2 to 3 bushels per acre during autumn. To minimize the ravages of birds, the seed should be treated with red-lead or some other preparation, and other precautions, such as scaring the birds with gunshot, would be advantageous.

—*Fields Division.*

THE CONTROL OF WEEDS.

(Continued.)

3. METHODS OF DISTRIBUTION.

A. H. COCKAYNE, Director of the Fields Division.

THERE are many methods whereby weeds may become distributed from place to place, whether by means of seeds; spores, or individual pieces of the growing plants themselves. A clear conception of the various ways in which each individual weed is likely to be disseminated is of importance, inasmuch as this knowledge may often lead to management practices being adopted that will lessen the danger of spread. So far as our introduced weeds are concerned, they have been brought into this country, either accidentally or intentionally, in the ordinary commercial intercourse with other countries.

PRINCIPAL MEANS OF WEED-INTRODUCTION.

The following are the principal means by which weeds have been and are being introduced in overseas transport :—

As Seeds or Plants intentionally introduced for Cultivation on Farm or in Garden.

Just as the introduction of animals from other countries for sport, pleasure, and professedly economic purposes has led to the development of animal pests, so intentional plant-introduction has been the cause of the establishment of plant pests in the shape of weeds. The number of garden or farm-crop plants introduced that have become naturalized is not large, but among them are numbered some of our most noxious and dangerous weeds. Familiar examples are blackberry, originally introduced as a hedge and orchard plant; sweetbrier, introduced as nursery stock; and gorse and broom, introduced for hedge-plant purposes. The majority of the intentionally imported plants that have become serious weeds are of a shrubby nature, and the desire for live hedges has been responsible for the introduction of many plants that have become either generally or locally distributed as weeds. To those already mentioned, hakea, barberry, and elderberry can be added.

When one considers the vast number of different species that have been introduced and the small number that have become naturalized to any extent it is clear that the danger of importing plants that may become dangerous is not really very great so far as numbers are concerned; but at any time it is likely that a plant may be introduced that may become an unmitigated pest. For this reason it would appear to be a useful safeguard if there were some legislative regulations whereby promiscuous importation could be, if not checked, at least supervised to a certain extent. At the present time any plant, no matter how harmful it may be in its original home, can be freely imported, and certainly there should be some power whereby plants distinctly likely to be troublesome here could be refused admittance.

As Seed Impurities in Agricultural Seeds generally.

The majority of our introduced weeds of agricultural and pastoral land can be traced to this source—for example, thistle, dock, ragwort, spurrey, and a host of others. As both our annual crop seeds and grassland seeds were originally almost entirely introduced from Europe, it is easily seen most of our weeds are of European origin. The importation of weed-seeds in imported grasses and clovers goes on year after year, and tons of such a weed as sorrel are annually imported in clover-seed. This source of introduction in imported seed does not now result in the production of many "new" weeds, but simply means the bringing in of seeds of weeds already established here. Here again, however, it is likely that new weeds not present in the country may from time to time gain a footing.

No administrative action has been taken in New Zealand to limit the importation of weeds in ordinary commercial agricultural seeds; but many countries have stringent laws against the importation of any seed containing more than a certain percentage of impurities, or prohibiting the importation of any seed containing seeds of certain specified plants—generally, strange to say, the specified plants being established ones in those countries where the laws are in operation. In general it can be said that legislation against the introduction of any specified weed-seeds is quite ineffective, and only results in harassment of the seed trade without affording any real and sure protection.

There are, however, two methods of dealing with imported seed that appear to be worth adoption. One is prohibiting the importation of any agricultural seed containing more than a certain percentage of impurities. This in no way would stop the introduction of weed-seeds, but it would eliminate badly cleaned seed, would raise the general standard of all imported lines, and be decidedly beneficial. The other method that would appear to be sound and practicable is the examination of all imported seed, and the rejection of that containing seeds of plants not already established in New Zealand and which are clearly objectionable in those countries where they are growing. Without doubt, the matter is largely in the hands of the farmer himself by buying only seed guaranteed by the merchant to be free from any objectionable impurities.

As Seed in Ships' Ballast.

At one time this was a quite fruitful source of weed-introduction, but with the present almost universal use of water ballast is no longer serious. American wild rice—a bad grass-weed liable to block drainage-channels in the Northern Wairoa district—Bathurst burr, and quite a number of South American weeds owe their presence in New Zealand to ships' ballast.

As Seeds in Packing-material.

Straw and other material used in the packing of commercial goods can frequently contain weed-seeds. For instance, the horned poppy, abundant on sandy soils around the Wellington coast, was introduced in machinery imported for the Patent Slip at Wellington, and Californian-thistle seeds have been found in the straw wrappers around bottles.

As Fodder used for Stock during Overseas Transit.

This method of introduction was very common in the early days of settlement, but does not exist at present, as under Stock Act Regulations no fodder used for live-stock on board ship is allowed to be landed. Fodder, and particularly chaff, which is frequently imported into New Zealand, often contains considerable quantities of weed-seeds; but, generally speaking, they are of plants that are already well established here. Whenever importations of produce are being made on an extensive scale the danger of weed-importation is stressed by the local farming community; but certainly the clear method whereby this danger can be eliminated is for New Zealand to grow the whole of her stock-fodder requirements.

On Imported Stock.

Certain weed-seeds, especially those liable to cling to wool or hair, are quite likely to be imported on live-stock. Thus many of the Merino rams imported during the past few years contained quantities of burr clover in their fleeces, and Bathurst burr has been imported from time to time in the same way.

MEANS OF WEED-DISSEMINATION WITHIN NEW ZEALAND.

There are three main agencies of dissemination of weeds throughout the country—natural, human, and animal.

Natural Agencies.

Wind.—Wind is the most potent natural agency in the distribution of weeds, and many plants have developed seeds of a type that render them capable of being distributed long distances even by winds of moderate intensity. Well-known seeds of this character are particularly common in that family known as the Compositae—the thistle and daisy family. They are mostly provided with feathery structures that enable the seeds to be suspended in the air for long periods. At the present time there is hardly any forest country in the North Island that when cut down and burnt will not almost immediately produce an abundant crop of thistles or similar weeds, due to the immense number of wind-borne seeds that are in or on the ground. The clouds of thistle-down that one so frequently sees moving along in the wind are a striking testimony to the effect of wind on seed-dispersal.

The fact that forested country may annually have virtually tons of weed-seeds falling on the ground, and yet there is no establishment until the forest has been opened up or removed, can be viewed as giving the key to rational weed-avoidance. It shows how difficult if not impossible it is for plants to gain a foothold if suitable conditions for establishment are absent. So far as weed-control is concerned—on grassland, at any rate—it is the adoption of methods making establishment difficult that is biologically sound.

Running Water and Floods.—Streams and rivers, particularly when they are in flood, carrying as they do immense quantities of soil, are an important source of weed-dissemination. Not only seeds, but portions of plants themselves may by this means be transported great distances. The distribution of goat's-rue over all the land periodically flooded by the Manawatu River is a striking example of the water-dispersal of a weed, and there are many such examples in New Zealand.

Human Agencies.

General Transportation of Goods.—The main distribution of weeds by human agency comes about in the general distribution of agricultural materials in the course of their ordinary transportation over the country. Oats, chaff, hay, and other transported fodders, such as feed-meals that have been insufficiently ground and which are contaminated with weed-seeds, all play an important part in weed-distribution. With regard to certain weeds, notably Californian thistle, contaminated fodder has been more responsible for rapid and general distribution than has been the use of impure seed for sowing purposes. In the case of Californian thistle a peculiar idea has arisen in districts where thistle-infested oats and chaff are not uncommon—namely, that the seeds of this thistle will not germinate unless they have passed through an animal. It has been repeatedly demonstrated that such is not the case; and one of the plots at the recent Dunedin Exhibition, with an abundant crop of Californian thistle derived from seed taken from an infested line of grass-seed, clearly showed the fallacy of such an idea.

The avoidance of weed-distribution in contaminated fodder appears to be almost impossible. The Australian system of prohibiting the sale of such material has in practice been found to be more or less unworkable, and cannot in any way be carried out so as to fulfil its objective. It certainly must be said, however, that the indiscriminate distribution of weed-contaminated fodder in New Zealand has and is intensifying our weed problems; therefore it would appear to be sound to reduce this source of distribution so far as practicable. In the first place, the farmer on clean land should exercise great care in his purchases of fodder, and always bear in mind that the buying of weed-infested material will tend towards reduced production and increased expenditure on his farm. Again, the farmer likely to produce such material should carry out all practical methods to minimize the damage he is liable to cause the country. In this respect the clear recognition that he is damaging the country at large by selling badly weed-infested material without doubt would do much good in influencing him in not growing sale crops on the notoriously dirty portions of his farm until they were more or less adequately cleaned. It should also influence him to take advantage of certain practices with regard to early and late sowing and early and late harvesting, whereby the ripened weed-seed crop would not coincide with that of the crop he grows and intends to sell.

The policy of crop quarantines in different localities, and the prohibition of the sale of weed-infested crops, should, in my opinion, be regarded as a last resort. Education, rather than compulsion and restriction, is more likely to have permanent benefit, and the use of clean seed and the production of clean crops should be looked upon by every farmer not only as a necessity but as a duty.

Farm Implements.—These implements are a frequent source of weed-dispersal. This is especially true of threshing-machines and drills. It is hard to see how the position can be improved, but the real recognition that they are sources of contamination would at least do some good, and tend to their better cleaning, particularly in the case of threshing-machines.

Stable Manure.—Stable or farmyard manure is often a source of weed-distribution. Care should be taken to store manure in such a

way that the fermentation processes really destroy the weed-seeds present. The proper rotting of stable manure should be looked upon as essential. Unless such rotting is carried out the disadvantages of stable manure as a means of infesting land with weeds may outweigh its advantages in increasing the fertility of the land to which it is applied.

Animal Agencies.

There are two main types of animals responsible for the dissemination of weeds—namely, ordinary farm live-stock and birds. Ordinary farm live-stock, such as horses, sheep, and cattle, distribute weed-seeds either by carrying them on the outside of their bodies or by eating and then voiding them in their excreta in a condition capable of germination. The influence of live-stock in both these directions is very great—fortunately, indeed, in many cases to the advantage of the grassland farmer, for useful as well as noxious seeds can be so distributed over wide areas at no cost to the farmer. For example, the spread of white and many other clovers on to land where they have never been sown can be almost wholly attributed to the action of live-stock. The swamp-reclaimed portions of the Ruakura Farm of Instruction offer remarkable examples of the value of stock in spreading useful seeds. Cattle and horses are greater factors in the spread of weeds by means of manure droppings than are sheep, but the latter carry large quantities of seeds in their fleeces, particularly during certain times of the year.

Just as many seeds are specially constructed to enable their easy conveyance by the agency of wind, so many seeds are constructed by nature in a manner that carriage on the wool or hair of animals is facilitated. The following are some examples of these adaptations:—

Minute size of seed enabling it to remain for a considerable time in the fleece of a sheep: Foxglove and mullein are good representatives of this class. The presence of foxglove on a farm, often attributed to the use of impure seed—a supposition generally wrong—can often be traced to the bringing of stock from foxglove-infested country.

Fruits or seeds, with hooks or barbs: Piripiri, burr clover, and Bathurst burr are familiar examples of weeds that are capable of being widely distributed by live-stock.

Fruits or seeds having hairs: Tauhinu and many of the smaller-seeded composites are provided with a hairy pappus, and large quantities of such seeds may be carried in fleeces. Danthonia, with its hairy seed, is regularly distributed over wide areas.

Fruits or seeds that tend to pierce the skin: Barley-grass, hair-grass, rice-grass are representatives of this class. The distribution of the last-named is valuable.

Buying-in of Stock.—In the purchase of stock considerable attention has often to be paid both to the weeds present on the land they have been grazing on and the time of year they are bought, in order either to avoid or at times to encourage the distribution of seeds on to any particular farm. Thus, for instance, in coastal districts great care has often to be taken to avoid the purchase of stock from tauhinu country during the period when the seed is likely to be in the fleece, which is in late summer and early autumn. Again, the purchase of stock from piripiri-infested country is quite dangerous for new burn country that

is beginning to lose the fertility derived from the ashes. Foxglove is another weed that is likely to be introduced by bought-in stock.

As has been mentioned, the seeds clinging to the wool of stock are quite likely to prove advantageous in certain cases. This is particularly true of country which it is desired should come into danthonia. The purchase of sheep from country where danthonia has seeded freely is regularly effected with the express intention of bringing in considerable amounts of the seed in the fleeces.

Birds are a frequent cause of weed-distribution. Among weeds that are spread far and wide by this means may be mentioned blackberry, ink-weed, and black nightshade. Waterfowl, again, frequently convey seeds over long distances. The general distribution of the floating buttercup within a few years of its introduction is a case in point.

DISTRIBUTION ON THE FARM.

So far as the distribution of weeds on individual farms is concerned, all the methods above enumerated come into play with regard to their actual conveyance, but the actual increase and infestation of any farm, or any portion of a farm, with weeds is largely a matter of what type of management is carried out, and whether it tends to assist or restrict their establishment and spread. The principles here involved will be dealt with later when methods of control are being discussed.

(To be continued.)

WATER-HYACINTH IN HAWKE'S BAY.

With reference to the note, "Water-hyacinth in New Zealand," published in last month's *Journal*, inviting the supply of local information and experience regarding this plant, Mr. L. M. Monckton, of Waipukurau, writes to the Editor as follows:—

"I have two dams, one of about 1 acre and the other of 2 acres. Thirteen years ago there was no sign of water-hyacinth on either, but a few years later it appeared on both, evidently brought by wild ducks from other dams in the district, where it has been for over twenty years. The weed started from the edges and worked towards the centre of the dams, which are now covered with the hyacinth, except for a small portion in the deepest parts near the keys. So far it has done no harm—rather the other way, as it has stopped the waves which caused erosion of the keys of the dams, and ducks frequent the dams in greater numbers than they did, owing to the shelter and feed caused by the plant. It appears to have done no harm to the water from the stalks rotting. Cattle are very fond of the weed, wading out into the dams till the water is almost over their backs, and pulling up and feeding on the succulent roots. The hyacinth is spreading into the slow-running creeks, and I have wondered if there was any danger of it harbouring the small water-snail that appears in the life-history of the liver-fluke."

The main factors in the management of established lucerne stands are avoidance of early cutting, avoidance of continuous grazing, winter cultivation with spring-tooth or rigid cultivators, top-dressing with superphosphate, and occasional liming.

For permanency of the best pasture-plants and maximum yields of annual crops efficient drainage is essential. When drainage is not provided satisfactorily by nature artificial methods must be resorted to.

SOME IMPRESSIONS OF FARMING IN THE NORTH ISLAND.

Paper read by G. S. PEREN, B.S.A. (Toronto), Professor of Agriculture, Victoria University College, Wellington, at the Annual Conference of the Royal Agricultural Society of New Zealand, May, 1926.

It is obvious that farming in the North Island, when taken as a whole, is gradually changing from comparatively extensive to more intensive methods, the degree of intensity reached varying with different districts. Extensive methods are invariably the practice in young countries possessing plenty of land, until, in the course of time, the pressure of economic factors brings about changes, which continue until a point is reached when costs of production, standard of living, and markets call a halt. Changes in costs and the gain or loss of markets for certain products may have marked effects on the kinds of farming followed, but the degree of intensity reached in any line will be governed largely by the three aforementioned factors.

It would be, undoubtedly, to the interest of all that New Zealand should produce the greatest volume of produce compatible with satisfactory profits for the producer, and I have been particularly interested in the possible lines of development in this respect. We hear a lot about Denmark and the standard of cultivation in some of the other European countries, and while it is very pleasant to travel through these countries and to note the way in which many parts of them are cultivated and the amount which the land is producing, yet to visualize a similar future for New Zealand would be but idle. The prime factors in each case are different, with the one exception of export markets, and the respective advantages and disadvantages do not cancel out. To endeavour in a comparatively few decades to bring a big body of raw country, mostly in forest and either hilly or mountainous, up to the standard of improvement of what we are pleased to call "Western civilization," and at the same time to be pioneers so far as standard of living is concerned, is to set yourselves a difficult row to hoe when at the same time you must compete in your markets with Continental Europe.

I am not anxious to see a nation of small holders as understood in Europe, but I do think that we should all like to see the country farmed in such a way that it would be producing reasonably near the maximum of which it is capable. If, in various ways, this degree of development is made impossible, much very valuable raw material will be deliberately sacrificed.

I think one can assume that dairying will gradually take possession of the bulk of the land suitable for that purpose. It seems to me that this is almost certain to take place, since the value of this land is so high that when large places come on the market they must in most cases be broken up, since no one person can afford the total purchase price; and those who take portions will in many cases be forced into dairying as being the most profitable line, and, generally speaking, the only line capable of paying off the big purchase price. I fancy that this process will gradually change most of the high-priced country

into small to medium holdings devoted to dairying, the only offset being those cases where a man owns his place free of debt and is so well off that he can afford to take less off his land and, from preference, changes over to sheep. Prices of dairy-produce have their ups and downs, but dairying is generally conceded to yield a higher profit per acre on suitable land than does sheep-farming.

The next question that rises in one's mind is the extent to which this land can be made to give greater yields at a satisfactory profit. The carrying-capacity may even now be relatively high on account of the favourable climate, but it does not follow that it is not possible to take even further advantage of the climate. I do not propose to discuss the very best dairying flats, but rather land nearer the borderline of dairying. It does appear to me that by a more liberal use of top-dressing and the growing of more hay and forage crops such land could be made to carry far more stock and do it better. I am frequently told, however, that the latter crops are very expensive and frequently do not pay, and to this I can only reply—since I have as yet no data on which to base my own opinions—that, if true, it is a very serious thing for the country, as being a reflex of very high costs of production. It means that dairy-farming, of all lines, can only stand the cost of a very small area of arable land, and that not only the best but even second-class pasture is more profitable by itself than with forage crops, in spite of the fact that it does not carry cows satisfactorily through a season without supplementary feed. First-class pastures probably are more profitable than arable, and in their case the latter should be kept to a minimum; but on the poorer dairying-country that minimum should be very much larger to produce efficiency, yet such a minimum is apparently unprofitable. If true, it is very unfortunate, as it will restrict the dairying-country, the area which lends itself especially to better methods, greater production, and closer settlement. As most of you are no doubt aware, people in many countries are dairying successfully on land on which you would never dream of running anything but beef cattle and sheep: it is all a matter of costs in relation to prices. The higher the total cost of production the less the volume of produce it will be possible to get out of your land, since you market in Europe and not in the country where the costs originate, and where prices should be more or less compatible. European prices may rise and help you out, but higher prices would offer a very big profit to European countries with much lower costs, and they would tend to increase their production, with a consequent lowering effect on prices.

Turning to the further development of the sheep-country, better subdivision and pasture-management, and, where feasible, top-dressing, will in many cases undoubtedly improve carrying-capacity. At the same time I fancy we shall have to face in some cases a shrinkage in hill country which economic factors make impossible to handle—*i.e.*, land on the boundaries of farming which probably should not have been taken up.

So far as population is concerned, one supposes that gradually the larger stations will be broken up and the average size of runs decrease. With respect to this aspect, it has struck me that in many cases there is a real danger of overdoing subdivision. A lot of country can only

be handled by big men with plenty of capital; and again, some of the smallest subdivisions appear to me to be uneconomical from the point of view of the full employment of the owner's time.

I have been rather appalled at the amount of hill country which is "going back." In a mountainous country, however, one must expect a lot of poor land. Apart from the exhaustion of the residual effects of "burns" and the drain of continuous stock-raising, one must expect deterioration due to topography once the forest covering is removed, unless the soil is very carefully handled and a good sward is maintained. In this respect I have frequently noticed men ploughing high-lying hillsides of a very light nature which had "run out," but which, in my opinion, should never be touched by a plough. Such a procedure may work for some time, but in the long-run the washing of such soils will reduce the fertility to a very low standard. It would be wiser to be content from the beginning with a good second-class permanent pasture produced by top-dressing. It seems to me that the best we can hope for is top-dressing of the more accessible country where costs permit, and a reversion of the more inaccessible country to a more or less stable standard of pasture determined by local factors. In many cases the standard will be distinctly third class, but we shall be lucky if we can hold that clean, and to do so will require careful handling, subdivision, and spelling, and perhaps, where possible, burning and reseedling with more suitable grasses. Such a statement implies a shrinkage in the carrying-capacity of certain types of country, and this, I fancy, will be the case, and must be realized when considering the future of the industry.

So far as undeveloped land is concerned, while I have seen a lot of it, including much of the North Auckland Peninsula as far up as Kaitaia, and have formed certain opinions, I do not propose to touch on the subject until I have been longer in the country. I have found a tendency in some people to regard all land as potential farming-land—the "Open sesame" being science. I would remind you that even in European countries there are areas which do not pay to touch, and that in very many cases the greatest difficulty in the problem of applied research is to find a treatment which is sufficiently cheap. The poorer the inherent nature of a piece of country the greater the difficulty. The higher the cost of production in relation to market prices of produce the sooner land becomes unprofitable to handle as we work down the scale of classes of land. High prices of an apparently permanent nature tend to bring into use land which previously did not pay to touch, but a continuation of high prices also tends in the course of time to encourage the growth of costs of production.

Personally I feel that there is a great field for expansion through the drainage of low-lying and swamp areas. I regard this as one of the most promising lines of development in the country, judged from the point of view of kind of land. Feasibility of drainage and cost are the two big hurdles, but there is the potential land if you can only get the water off it successfully at a reasonable figure. One is very pleased to see the work in progress on the Hikurangi and Kaitaia Swamps. Even though some of the lowest parts may always be wet, a big volume of produce eventually should be added to the country's

output. Such land will, I fancy, prove more attractive to men starting out than land on the margin of the profitable country where costs of purchase and "bringing in" may be greater than the market value of the final product. To this there is the exception of good land at present under timber leases, &c., which may be thrown open from time to time, and certain other classes of land such as "gum" land and certain pumice country, the handling of which is rather in the experimental stage.

I think that most new-comers are impressed with the need of farm drainage throughout the country. Cost is again the stumbling-block, and one must not expect a new country to be thoroughly developed in respects of this sort. Such improvement will, I hope, come slowly but surely. I do think that some men dismiss the project too hastily through lack of appreciation of the benefits to be derived therefrom. Again, others lose faith through poor results following faulty planning or an insufficient drainage system. However, one sees many farms throughout the country where small areas, usually of the best soil, are not doing more than half of what they are capable merely for lack of drainage.

Reverting to the subject of forage, I cannot say that I have been impressed with the general standard of the crops grown. This, I fancy, is due to a lack of appreciation of the value of the careful handling of soil and to insufficient intercultivation of the crop. You are primarily graziers and stockmen, and—forgive me for saying so—it is my experience that men of these interests are not, as a rule, such good arable farmers as those who are regularly engaged in a large amount of arable work. I would remind you that on land set aside for a rotation of forage crops, oats, and temporary pastures—which, with the growing use of top-dressing and permanent pasture, will, I fancy, become a feature of most farms—a cleaning crop is essential, and this means intercultivation. The only other check, and one far less efficient, is a smother-crop. I feel sure that a little extra attention would pay for itself in increased yields. Weeds are a very much more serious competitor with crops than one might imagine. Incidentally, the percentage of waste in many of the haystacks one sees must be enormous.

The interest which is being taken in top-dressing and pasture-management is very encouraging. It appears to me that, taking all factors into consideration, top-dressing is more capable of effecting a big increase in the production of the country than any other one method available. Where conditions permit, the use of fertilizers to produce permanent pasture is far better practice than putting in a plough as soon as serious deterioration occurs. Under careful management permanent pastures improve with age—one might almost say "They become a strength unto themselves." The amount of humic matter in the top soil is greatly increased, and a medium is formed in which grows a really wonderful turf which is far more drought-resistant and self-supporting than new pastures. At Home this condition is considered very valuable on account of the time required to produce it, and it is considered a sin to plough up good grass which has reached this stage. A certain area is essential for forage crops, and temporary leas for certain lines of

farming, but unless climatic conditions dictate I do not consider it wise to bring the whole of a grazing-farm into a rotation, however long.

I have been impressed at the omission of the rolling of pastures. It is true that the small amount of frost is not likely to cause any heaving of the grass-plants, but as a remedy for "poaching" and the habit which grasses have of "lifting" themselves I consider it well worth while. It does not take long, and can be done by a boy. After all, we know the way in which a lawn benefits from rolling.

I would emphasize that grazing is an art. Pastures are a crop which requires consideration and careful management, as in the case of other crops. A man should know his grasses and keep a continual eye on their behaviour. To treat them as so much "grass" on which to run stock, and to leave them largely to take care of themselves, is to drop money.

Live-stock is a very controversial subject, the question very often being a matter of opinion. I may say, however, that I think that, generally speaking, the quality of the stock in the country is good. There is plenty of room for improvement, but that applies to all countries. Personally, I think that some of the Jersey breeders are going in for too fine a type of beast. You may say that I have been brought up to the American type of Jersey, but I am basing my remark solely on my ideas of type as exhibiting the constitution necessary to stand up to very exacting work generation after generation. I have been disappointed in the dairy Shorthorns—not only quality but dairy type is so frequently missing. Again, beef Shorthorns do not seem to be up to the same standard as the other beef breeds in the country.

Naturally, I have been surprised at the scarcity of pigs in the country. To go into the subject fully and discuss ways and means would require a separate paper, and I shall merely confine myself to the statement that if you are aiming at the bacon-market I think it would be sound policy either to select your Berkshires very carefully for the lengthy type, or else to use a breed or breeds which conform more closely to what is recognized as the correct bacon type. Although I have been told by an English importer that he was getting good carcasses from New Zealand, yet I think that, while you may be producing reasonably good sides, it would be better business to use a pig which did not waste so much food in growing large quantities of the cheap cuts, particularly neck, shoulders, and jowl. The short chunky type of Berkshire is nothing more than a porker or lard-hog—excellent for that purpose, but far from suitable for bacon. The lengthy type of Berkshire has a better side, but even in the cross with the Tamworth, which is a good bacon pig, that useless weight of flesh in the fore quarters and neck is usually in evidence, with a tendency to too much belly-fat. The most valuable meat on the bacon pig is the side from the back of the shoulder and including the gammon. The type of pig required by the bacon-curers has been so clearly and definitely described by them on many occasions in their propaganda to encourage uniformity that the subject admits of no doubt. I think that people often become very fond of the Berkshire because, on account of fineness

of bone, coupled with a capacity for doing well, they are usually nicely rounded off at all points and thus appear such a well-finished article. They undoubtedly produced excellent Wiltshire sides in the days gone by, but the public is now demanding a different type of bacon, and the curer is bound to regulate his price to cover the amount of low-value meat which he has to buy along with the good cuts.

Another feature of this country which has impressed me is the lack on most of the larger places of houses for married farm hands. I know the reason, but that does not help matters. A good comfortable house and pleasant surroundings are a wonderful influence in keeping help, and the value of good men who have been with you for years can hardly be overestimated. They know your land and its peculiarities, your stock, and your ways, and they save you a tremendous amount of extra work, worry, and bad temper. I can quite understand that lack of accommodation must accentuate the difficulty of obtaining help of the right quality.

There are, naturally, a number of other points on which one could touch did time permit, and, again, if one were more certain where one stood as regards costs. It would appear that the costs of starting to farm are very high, and that many who have started in the last few years are in difficulty, sometimes no doubt due to bad luck or undue optimism. However, it should be remembered that the financial soundness of the industry should be gauged by the experiences of those who have purchased their land at recent prices (excluding absurd figures), rather than of those who bought in the days when the availability of new land kept prices down.

In conclusion, I may say that I think that the extent to which the country has been developed in such a short time reflects very great credit on the pioneers. The climate is indeed a wonderful asset, and I think that the land should be capable of producing a much greater volume of produce than at the moment. That this development will be economically possible I sincerely hope, since the country is comparatively small if one subtracts the mountain areas, yet is entirely dependent on its agriculture, and likely to remain so for some considerable time. I myself do not think that the point has been reached where the Law of Diminishing Returns comes seriously into operation, and I feel that more attention to detail and, for example, the cost of an extra hundredweight of fertilizer or a little more cultivation, would increase yields quite out of proportion to the slight additional cost.

It is far from likely that you will agree with all my remarks, and perhaps I shall change some of my ideas in the course of the next few years; these, however, are my first impressions.

Noxious Weeds Order.—The Gore Borough Council has declared that Californian thistle and ragwort shall be deemed *not* to be noxious weeds with that borough.

For concrete-work material should be used in the following proportions: For posts—one part of cement to five or six parts of aggregate; for light but very strong work—one part of cement to four parts of aggregate; for bulky work not subjected to wear or stress—one part of cement to eight parts of aggregate.

CASTRATION OF LAMBS WITH THE BURDIZZO INSTRUMENT.

W. R. DAVIS, M.R.C.V.S., Departmental Veterinarian, Petone.

At some of the freezing-works of the Dominion during the past few months a number of ram lambs have been met with in which an abnormal condition of the testicles and their appendages has been observed, consisting in some cases of mere atrophy of the organs and in others of inflammation, hæmorrhage, &c. An endeavour was made to ascertain what had given rise to the condition, and it was suggested by the Director of the Live-stock Division that as a number of Burdizzo castrators had been imported, and inquiries received as to the merits of the instrument, the cause might lie in improper operation of this new method. Later this was found to be the explanation.

The Burdizzo castrator is applied to the skin of the purse above the testicles, and the cords crushed and obliterated, there being no cutting. It may add to the clearness of explanation if a few remarks are made regarding the structures involved. In the foetus the testicle lies behind the kidney, and shortly before birth it travels down to the middle line of the belly (opposite to where the abdomen joins the thigh). Here in the belly-wall there is a slit (inguinal ring), and through this the testicle passes to the purse or scrotum. In its passage through the slit the testicle pushes in front of it the membrane that lines the inside of the belly (peritoneum). This then comes to cover the inside of the purse, the testicle, and the structures that make up the spermatic cord on which hangs the testicle, these structures consisting of artery, vein, lymphatics, nerves, and a firm tube that carries the seed up from the testicle. The artery does not run down in a straight line, for, being as it were too long, it describes a series of curves in its course; and in castrating by any method it is important to remember this disposition of the vessel.

The Burdizzo, an Italian invention, was first introduced into England in 1912 by Mr. T. Brown, F.R.C.V.S., of Invergordon, who has used it ever since on bulls and tups with good results. Mr. Brown states in a letter: "All you have to do is to hold the spermatic cord firmly beneath the skin whilst any person closes the instrument over both the skin and cord. It is quite a bloodless and aseptic operation. The testicle may swell for a day or two, then it gradually atrophies, and disappears completely in a few weeks. It is quite as humane as any other method, and I have never seen a bull or tup show any signs of illness; they can be turned out in any kind of weather."

In the cases alluded to here the castrator had been applied too close to the testicle, and in many instances to the organ itself, the result being that the structures of the cord were not obliterated and the operation was followed by inflammatory and hæmorrhagic changes, suggesting, indeed, that the condition was the result of worrying by dogs.

Farmers who propose to use the instrument are advised to see that a grasp is taken on the cord well above the testicle. In order to do this the testicle should be grasped in one hand and pulled down so as

to tense the cord and efface the curves of the artery; the other hand should hold the cord in position. The instrument can then be applied and firmly closed by an assistant.

Some weeks should elapse before the animals are suitable for slaughter. The castrator is not suitable for very young lambs.

LAMB-FATTENING ON FORAGE CROPS.

TRIALS IN AWATERE DISTRICT, SEASON 1925 - 26.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

IN response to requests from the Awatere branch of the Farmers' Union (Marlborough) the Department of Agriculture undertook in September last to conduct a local co-operative experiment in lamb-fattening with supplementary forage crops. It was unfortunate that arrangements for these trials could not have been made earlier in the season, as the time available for cultivating the ground prior to the sowing of the various crops was far too short to allow of a sufficient length of fallow being given. The Blenheim branch of Messrs. Wright, Stephenson, and Co. kindly undertook to supply all the seed and manure necessary for experimentation. We are also indebted to Mr. C. P. Gainsford, on whose farm, at Seddon, the trials were conducted, for his close attention so freely given to the details of the experiment during its progress, and to Mr. N. West and Mr. C. Walker, stock agents, Seddon, for their help in drafting and classifying the fat lambs.

The paddock selected for the work was down in a temporary pasture consisting of Italian rye-grass and white and red clover. This pasture had been in existence for two seasons and had never been top-dressed. Previously the paddock had been cropped, the last taken being three cereal crops in succession—two of wheat and one of oats. Blood manure from a neighbouring slaughterhouse had been spread over the paddock from time to time, on an average of, say, once in three years.

The pasture was stocked mainly with sheep. The soil may be described as consisting of a mixture of alluvial deposits and papa. Eight acres were ploughed and worked for the sowing of crops, and this area was subdivided into four 2-acre blocks, and sheep-fences erected across the paddock to separate one block from another. Care was taken to eliminate the only interfering factor which might have been present in the shape of a row of *Pinus insignis* trees situated at the end of the plot devoted to peas, these trees being carefully fenced off to avoid the shade and shelter which might otherwise have been afforded to that section. Water was laid on to each plot by means of troughs filled by pipes from a tank, which was in turn filled by a windmill. The ground on these four plots was level, and about as even as could have been found. The soil is typical of flat country in the Richmond Brook, Seddon, Tetley Brook, and Seaview districts, somewhat poorer than the flats at Kaparu and Blind River, but roughly typical of many of the Ward, Dumgree, and Medway flats. A fifth area of the same size (2 acres, approximately) was fenced off from an adjoining lucerne-paddock, thus making five plots in all.

As much cultivation was given to the land as the short time at our disposal would allow, the ground being ploughed only once, disked once, harrowed twice, then rolled—admittedly insufficient tillage. Dwarf Defiance peas of the Marrowfat type were sown about 12th October at the rate of $3\frac{1}{3}$ bushels per acre. It may be stated here that the wrinkle pea, as a fodder plant for fattening, is much preferred to the ordinary field-peas—Partridge, and Prussian or Imperial blues—by Marlborough farmers. On 26th October rape in 7 in. drills, at 3 lb. per acre, and chou moellier in 21 in. drills, at 3 lb. per acre, were sown. There is reason to believe that where intercultivation can be practised the 21 in. drills are superior to the 14 in.—that is, drilling through every second coulter. The difficulty is that most farmers for various reasons do not intercultivate, so that probably the 14 in. drill will come into general favour. Japanese millet was sown on 27th October at 12 lb. per acre, the seed being mixed with the manure and sown through the manure-box of the drill. All the crops were drilled with 44 to 46 per cent. superphosphate at the rate of 2 cwt. per acre. Similarly, the lucerne plot was top-dressed with the same quantity of super per acre.

Right from the outset the peas made good growth, and when the lambs were turned on to the plots in January the crop had just matured, thus being at the right stage for feeding off. Judged in themselves they were easily the best crop in the paddock. It is very important to note that the fodder crops, until after the first draft of lambs was taken off, experienced the driest season Marlborough had known for ten years. Taking into consideration the season, the rape crop may be described as fair—better than the average in the district, but somewhat poorer than the best. Fortunately, the dry weather was not accompanied by serious trouble with the aphid pest. The chou moellier crop, considering the adverse weather conditions with which it had to contend, made quite a fair show. The millet was a failure. This may have been due to the fact that the preceding long wet winter had left the soil somewhat too cold for this crop. The lucerne made good growth prior to the lambs being turned on at the beginning of January. A hay-cut was made in November, and the hay stacked within the lucerne enclosure so that the lambs could nibble at it, it being considered that they should fatten better when hay was fed with the green fodder. This method was also regarded as something in the way of a precautionary measure against bloat.

As already indicated, the lambs were turned on to the plots early in January, forty lambs being allotted to each plot, with the exception of the Japanese millet plot, which was capable of carrying only twenty. The lambs, taken all through, were a fairly even lot when placed on the respective plots to graze. All were by English Leicester rams. It may be stated here that the common practice in the Awatere district is to cross the Leicester ram with the half-bred ewe, so that in the case of those lambs not sent away fat off their mothers or fattened off some supplementary fodder crop the quality of the wool may be maintained. In some of the very early districts, where a high percentage of milk lambs is easily obtained, the Southdown ram has recently been introduced with the object of breeding black faces. The lambs turned on to the plots at Seddon were at that time worth on the average about 18s. per head.

Mr. West, who made the first draft of fats on 2nd February last, stated that his classification on that day was well defined—that is, those lambs rejected as not fat were all such as would, on the average, require about the same time to fatten—another three and a half to four weeks. The results of the first draft were as follows:—

28 lambs off peas	= 70 per cent.
18 " rape	= 45 "
17 " chou moellier	= 43 "
11 " lucerne	= 28 "
16 " millet	= 80 "

The millet was so infested with weeds (chiefly fat-hen) that the test of that crop could not in any way be considered a fair one. It was therefore decided to disregard the results from this plot.

At the date of drafting, after three and a half weeks of grazing, the pea crop was finished, as was likewise the Japanese millet. The rape, chou moellier, and lucerne were shut up to allow them to come away again. The lambs set aside as not fat were taken right away from the plots and turned out on to another part of the farm.

The report on the first draft of lambs sent away as fat to the Picton freezing-works was as follows:—

Lambs off Peas (28).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	8	259	32·37	At 9½d. = 10 10 5
36 lb. to 42 lb.	2	76	38·00	At 8½d. = 20 10 2
Second quality (under 36 lb.)	18	503	27·94	
	28	838	29·92	31 0 7

Allowance for trucking and drafting, at 6d. per head .. 0 14 0

Less railage 31 14 7
0 11 7

Average price per head delivered at works, £1 2s. 3d.

£31 3 0

Lambs off Rape (18).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	11	323	29·36	At 9½d. = 13 2 5
Second quality (under 36 lb.) ..	7	214	30·57	At 8½d. = 7 11 7
	18	537	29·83	20 14 0

Trucking and drafting, at 6d. per head 0 9 0

Less railage 21 3 0
0 7 8

Average price per head delivered at works, £1 3s. 1d.

£20 15 4

Lambs off Chou Moellier (17).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	11	338	30.72	At 9½d. = 13 14 7
Second quality (under 36 lb.)	6	175	29.16	At 8½d. = 6 3 11
	17	513	30.17	19 18 6
Trucking and drafting, at 6d. per head				0 8 6
Less railage				20 7 0
				0 7 2
				£19 19 10

Average price per head delivered at works, £1 3s. 6d.

Lambs off Lucerne (11).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	7	220	31.42	At 9½d. = 8 18 9
Second quality (under 36 lb.)	4	111	27.75	At 8½d. = 3 18 7
	11	331	30.09	12 17 4
Trucking and drafting, at 6d. per head				0 5 6
Less railage				13 2 10
				0 4 8
				£12 18 2

Average price per head delivered at works, £1 3s. 6d.

The second draft was turned on to the lucerne, rape, and chou moellier on 1st March, the numbers being allotted as follows: Lucerne, 19; rape, 28; chou moellier, 17. These lambs were worth approximately 16s. per head when moved on to the plots. It will at once be evident from the allotment of lambs that the rape had made far better growth than either the lucerne or the chou moellier in the interval from 2nd February to 1st March. It must also be noted that towards the end of February the drought broke, and, although the weather after that date was again somewhat dry, good heavy rains of 1 in. or more at intervals of ten to twenty days were experienced.

After the lambs had been on the plots for four weeks the second draft was made on 29th March. From the lucerne eighteen were taken off fat and one rejected; from the chou moellier sixteen were taken off fat and one rejected; from the rape twenty-seven were taken off fat and one rejected.

The following is a summary of the freezing-works report on the second draft :—

Lambs off Lucerne (18).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	7	224	32.0	At 8½d. = 8 3 4
36 lb. to 42 lb.	3	118	39.3	At 7½d. = 3 13 9
Second quality (under 36 lb.)	8	238	29.7	At 7½d. = 7 8 9
				19 5 10
Trucking and drafting, at 6d. per head				0 9 0
				19 14 10
Less railage				0 7 6
				£19 7 4
Average price per head delivered at works, £1 1s. 6d.				=====

Lambs off Chou Moellier (16).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	7	231	33	At 8½d. = 8 3 5
36 lb. to 42 lb.	5	190	38	At 7½d. = 5 18 9
Second quality (under 36 lb.)	4	120	30	At 7½d. = 3 15 0
				18 2 2
Trucking and drafting, at 6d. per head				0 8 0
				18 10 2
Less railage				0 6 8
				£18 3 6
Average price delivered at works, £1 2s. 9d.				=====

Lambs off Rape (26, exclusive of one reject dead).

Grade.	Number.	Net Weight.	Average.	Price.
		lb.	lb.	£ s. d.
To 36 lb.	25	810	32.40	At 8½d. = 29 10 7½
36 lb. to 42 lb.	1	38.25	38.25	At 7½d. = 1 3 11
				30 14 0½
Trucking and drafting, at 6d. per head (27)				0 13 6
				31 8 0½
Less railage (on 27)				0 11 3
				£30 16 9½
Average price per head (on 26) delivered at works, £1 3s. 9d.				=====

Observations made four weeks after the second draft had been taken off the plots showed (1) that a fair growth of rape had come again, (2) that there was only a small growth on the chou moellier, and (3) that there was very little growth on the lucerne. It is important to note that very little of the hay in the lucerne enclosure was eaten either by the first or by the second group of lambs.

The following tables indicate the comparative values of the crops:—

Cost of Production of Crops: Labour, Seed, and Manure (Rent not included).

Crop.					Per Acre.	Per Plot of 2 Acres.
					£ s. d.	£ s. d.
Peas ..	..	..	..	..	5 6 0	10 12 0
Rape ..	..	..	..	..	2 8 3	4 16 6
Chou moellier ..	..	..	..	..	2 17 0	5 14 0
Millet ..	..	..	..	..	2 10 0	5 0 0
Lucerne ..	..	..	..	..	1 16 0	3 12 0*

* Allowing for haymaking and top-dressing.

Gross Gains on different Crops.

Crop.	Value when Lambs put on.	Value when Lambs taken off.	Gain.
FIRST DRAFT.			
Peas ..	28 at 18s.=25 4 0	28 at £1 2s. 6d.=31 3 0	5 19 0
Rape ..	18 at 18s.=16 4 0	18 at £1 3s. 1d.=20 15 6	4 11 6
Chou moellier ..	17 at 18s.=15 16 0	17 at £1 3s. 6d.=19 19 6	4 3 6
Lucerne ..	11 at 18s.=9 18 0	11 at £1 3s. 6d.=12 18 6	3 0 6
SECOND DRAFT.			
Rape ..	27 at 16s.=21 12 0	26 at £1 3s. 9d.=30 17 6	9 5 6
Chou moellier ..	16 at 16s.=12 16 0	16 at £1 2s. 9d.=18 4 0	5 8 0
Lucerne ..	18 at 16s.=14 8 0	18 at £1 1s. 6d.=19 7 0	4 19 0

Summary.

Crop.	Gain from Lambs.	Cost of Production of Crop.	Net Profit or Loss on 2-acre Block.
Peas ..	£ s. d. 5 19 0	£ s. d. 10 12 0	4 13 0 loss.
Rape ..	13 17 0	4 16 6	9 0 6 profit.
Chou moellier ..	9 11 6	5 14 0	3 17 6 "
Lucerne ..	7 19 6	3 12 0*	4 7 6 "

* Including haymaking.

It will be seen from the above figures that there was an actual loss from the pea crop of £4 13s. The price of wrinkle-pea seed was high—18s. per bushel—thus costing £6 to sow 2 acres. Had field-peas been used, at 6s. 6d. per bushel, the seed would have cost £2 3s. 4d., thus reducing the cost by £3 16s. 8d. However, experience shows that the results with this class of pea would be poorer, so that there would most likely still have been a loss. The margin from the chou moellier crop was small—£3 17s. 6d. from 2 acres. Had the season been more favourable, however, there is reason to believe that the margin from this crop would have been considerably greater. In the case of lucerne

the cost of production was really only about 16s. per acre for top-dressing (£1 12s. for 2 acres). An amount of £2, however, was added for the making of 2 tons of hay, which the lambs scarcely touched. Had this allowance not been made, the net profit would have been £6 7s. 6d. instead of £4 7s. 6d. Rape, however, although a relatively inferior crop in this case, easily led the way with a net profit of £9 os. 6d. from the 2-acre block. On a per-acre basis the results might be expressed thus:—

Peas, £2 6s. 6d. loss per acre.	.
Rape, £4 10s. 3d. profit per acre.	.
Chou moellier, £1 18s. 9d. profit per acre.	.
Lucerne, £2 3s. 9d. profit per acre.	.

As previously mentioned, the crops had to contend with the worst drought experienced in Marlborough for ten years. For this reason in particular the experimental tests have been important. It is intended to extend these trials over a number of seasons.

WHITE AND SUCKLING CLOVER SEEDLINGS.

HOW TO DISTINGUISH THE TWO SPECIES.

J. W. CALDER, B.Sc., B.Ag., Canterbury Agricultural College, Lincoln.

IN the adult stages white clover (*Trifolium repens*) and suckling-clover (*T. dubium*) are easily differentiated. In their seedling stages, however, they are very similar, and the farmer may have difficulty in deciding whether he has a strike of white or of suckling in his autumn stubbles.

For the purpose of obtaining plants for study, seeds of both species were sown at this College, and their contrasting characters noted at two different stages. The first stage is when the seedling has produced the first single leaf; the second stage is when the first trifoliate leaves have been produced.

FIRST STAGE—SINGLE LEAF.

The distinguishing characters in the first stage are—

(a.) Shape of the leaf: In both clovers the leaf is obtuse and broad at the base. In white clover it tapers to a broad apex (Fig. 1); in suckling-clover there is no taper, the leaf being as broad at the apex as at the base (Fig. 2).

(b.) Appearance of the veins: These are clearly seen on the back of the leaf. In white clover the veins are branched at the tips (Fig. 1), while those of suckling-clover are undivided (Fig. 2).

(c.) Margin of the leaf: The margin of the white-clover leaf is notched at the veins (Fig. 1); the margin of suckling-clover is entire (Fig. 2).

(d.) Stipules: These are a pair of expansions at the base of the leaf-stalk, where they embrace the stem and its growing-point. The shape and appearance of the stipules are the most certain distinguishing

character between the two clovers. In white clover the stipules are broad and transparent (Fig. 8); in suckling-clover they are pointed and as green as a leaf (Fig. 9).

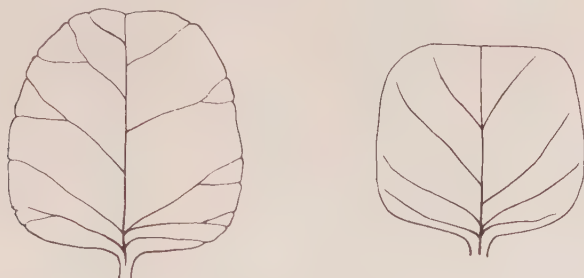


FIG. 1 (LEFT). FIRST SINGLE LEAF OF WHITE CLOVER.

FIG. 2 (RIGHT). FIRST SINGLE LEAF OF SUCKLING-CLOVER.

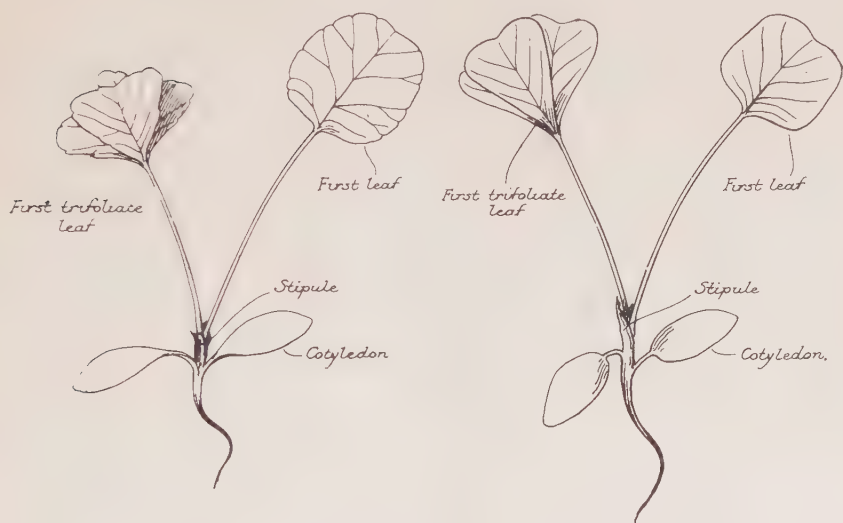


FIG. 3. WHITE-CLOVER SEEDLING.

FIG. 4. SUCKLING-CLOVER SEEDLING.



FIGS. 5 AND 6 (LEFT). WHITE-CLOVER TRIFOLIATE LEAFLETS.

FIG. 7 (RIGHT). SUCKLING-CLOVER TRIFOLIATE LEAFLET.



FIG. 8 (LEFT). STIPULES OF WHITE CLOVER.

FIG. 9 (RIGHT). STIPULES OF SUCKLING-CLOVER.

SECOND STAGE—FIRST TRIFOLIATE LEAVES.

In the second stage—that is, when the first trifoliate leaves have appeared (Figs. 3 and 4)—all the preceding differences are still to be noticed, and in addition the following differences between the leaflets of the trifoliate leaves:—

(a.) Shape of the leaflet: In white clover there is a short taper from apex to base, and the leaflet is as broad or broader than it is long (Figs. 5 and 6); in suckling-clover there is a long taper from apex to base, and the leaf is longer than it is broad (Fig. 7).

(b.) Appearance of the veins of the leaflet: The veins are again easily seen on the back of the leaflets. In white clover usually the second and third veins from the base are branched (Figs. 5 and 6); in suckling-clover the veins are undivided (Fig. 7).

(c.) Margin of the leaflet: White clover has minute teeth opposite the veins (Figs. 5 and 6). The margin of suckling-clover is entire (Fig. 7).

(d.) Stipules of the trifoliate leaf: Here again this is the most definite distinguishing character, and is the same as for the first leaf. In white clover the stipules are broad and transparent (Fig. 8), and in suckling-clover they are pointed and green (Fig. 9).

These characters remain constant to differentiate the adult plants, where also the flower and general habit give easy distinguishing features.

SUMMARY.

White Clover.—First leaf obtuse with gradual taper from base to apex, notched margin, branched veins. Leaflet of trifoliate leaves—short taper from apex to base, toothed margin, branched veins. Stipules of all leaves broad and transparent.

Suckling-clover.—First leaf obtuse, as broad at the apex as at the base, entire margin, undivided veins. Leaflet of trifoliate leaves—long taper from apex to base, entire margin, undivided veins. Stipules of all leaves pointed and green.

WINTON AND GORE EXPERIMENTAL AREAS.

NOTES ON OPERATIONS, SEASON 1925-26.

R. MCGILLIVRAY, F.L.S., Instructor in Agriculture, Invercargill.

(1.) Winton Area.

A USEFUL year's operations may be claimed for the Winton Experimental Area in 1925-26. General interest has been evinced in the working of the Area, but the main attraction centred on the various pasture blocks and their treatment. The attendance of farmers throughout the year has been good. Two field-days were held. The first, on 12th February, although wet, was attended by sixty-three persons, and on the second occasion approximately two hundred were present.

During the year a further 10 acres in the new portion of the Area were swamp-ploughed. About half this block was in rushes, &c., and considerable difficulty was experienced in working up the land for the various crops.

The work carried out and results obtained on each block are as follows :—

PASTURE INVESTIGATIONS.

Block 1 was sown in permanent pasture during October, 1925, the seeding being as follows: Timothy, 4 lb.; crested dogstail, 3 lb.; meadow-foxtail, 4 lb.; cocksfoot, 8 lb.; *Poa trivialis*, 1 lb.; white clover, 1 lb.; red clover, 1 lb.; alsike, 1 lb.; *Lotus major*, 1 lb. In addition, the area was divided into three equal portions, and meadow-fescue added to the mixture already recorded at the rate of (a) 8 lb., (b) 16 lb., and (c) 24 lb. per acre. It will be noted that perennial ryegrass was not included in this mixture. This experiment is for the purpose of ascertaining how far meadow-fescue may be made use of to replace perennial ryegrass in a permanent pasture under the conditions of this district. Two-thirds of the block were limed with carbonate of lime at 1 ton per acre prior to laying down in grass. Superphosphate, 2 cwt. per acre, was applied at time of sowing. Grazing was commenced on 2nd January last, and the general condition of the pasture is satisfactory.

The treatment and seeding of Block 2 were the same as for Block 1, with the exception that meadow-fescue was replaced by perennial ryegrass in each of the three subdivisions. Grazing was commenced on 4th January last. The carrying-capacity for the period ending 31st March was considerably higher than in the case of Block 1, and the pasture generally is closer. Where only 8 lb. per acre of perennial ryegrass was sown the individual plants appear to be somewhat larger than where 24 lb. was included in the mixture.

Block 3: A special article dealing with the liming and top-dressing experiments on this block appeared in the *Journal* for April last. The carrying-capacity was nearly five sheep per acre per annum, and in addition to this a crop of hay to the value of £4 was sold off the block. The amount received for grazing was £19 15s. 2d. for the year.

Block 4 is a permanent pasture which in point of carrying-capacity and general condition would be hard to excel. It was laid down in

1920, and has been top-dressed twice with basic slag at 3 cwt. per acre. The carrying-capacity for the past season was nearly eight sheep per acre per annum, and would have been greater if more stock had been available towards the end of the year. In connection with operations on this block an account was kept of the expenditure on rent, fertilizers, labour, &c., the total amounting to £14 12s. The income from grazing amounted to £27 os. 1d., equivalent to a net return of £2 9s. 7d. per acre.

A temporary pasture, containing a certain amount of perennial rye-grass, was sown towards the end of 1923 on Block 5. The amount of grazing afforded by this area during the year has been small. It actually carried 1.8 sheep per acre per annum, and when rent and labour charges are taken into consideration it shows a heavy loss, as the grazing revenue was only £3 16s. 10d. This was a splendid illustration of the kind of pasture not to have, and it served its purpose well. Although a losing proposition, it was of great value in drawing the attention of farmers to the futility of expecting good returns from run-out pastures.

Rates of seeding : On Block 6 there are five 1-acre areas sown with various clovers, with the addition of perennial rye-grass at 10 lb., 20 lb., 30 lb., 40 lb., and 50 lb. per acre. The experiment was laid down to determine a suitable sowing per acre of perennial rye-grass. The 20 lb. and 30 lb. per acre sowings have proved the most desirable in so far as this block is concerned. In the case of the 10 lb. per acre sowing the plants are rather large and coarse in the height of the growing season, while in the 40 lb. and 50 lb. per acre sowings there has been a considerable death-rate, and it is doubtful if either of these areas now show more plants per square yard than where only 30 lb. was sown. In 1924 this block was top-dressed with Nauru rock phosphate at 3 cwt. per acre, two control areas being left for comparison purposes. No increase was obtained from the application of the phosphate. It was therefore decided not to top-dress in 1925, but to make careful observations during the 1925-26 season to determine whether any results were forthcoming from the treatment of 1924. None was obtained, however, the growth being as good on the controls as on the Nauru treatment, and the sheep did not show any preference. The whole of this block has been limed with carbonate of lime at 2 tons per acre. The carrying-capacity was slightly over three sheep per acre per annum, and the grazing revenue was £11 18s. 4d. This does not balance the expenditure when rental, harrowing of pasture, &c., are taken into consideration. The manurial treatment for the 1926-27 season will consist of superphosphate on half and basic slag on the other half, and interesting comparisons are looked for.

OATS VARIETY TRIAL.

Areas of 1 acre each of five varieties were sown on Block 8. The manurial treatment was 2 cwt. superphosphate per acre. The varieties and yields per acre were as follows : Captain, 44 bushels ; New Abundance, 75 bushels ; Providence, 70 bushels ; Black Supreme, 54 bushels ; Crown, 73 bushels.

SUNDRY CROPS.

Oats and tares : This crop was sown on Block 9 in October at $1\frac{1}{2}$ bushels of seed for each constituent. An area of 1 acre on this

block had not been limed, and it was noticeable that the tares were much less vigorous on this part; the development of seed was so poor that the block was cut for hay, while the other portion was allowed to go for a seed crop. Weights taken early in the year gave on the limed portion $8\frac{1}{2}$ tons green material per acre, while on the unlimed part the green weight was 5 tons per acre. This was a very weedy block, but the strong growth of tares has smothered most weeds and left a clean stubble.

Block 10 was sown in May, 1925, in Emerald rye-corn, and gave a large amount of spring and summer grazing. It was ploughed in January last, and in February was limed with 1 ton of carbonate of lime per acre, then sown in (1) oats and winter vetches, (2) oats and Moumahaki vetches, and (3) oats and *Lathyrus tingitanus* for seed-production purposes—also as a smother crop, this area being badly overrun with Californian thistle. The fertilizer used was super, 2 cwt. per acre.

On Block 13 areas of 8 acres in Black Supreme oats for chaff and 2 acres in oats and Partridge peas for hay were grown. The land was not in very good order, and considerable further work, such as drainage and liming, will have to be undertaken. The yield of chaff was 30 cwt. per acre, and 30 cwt. of hay per acre from the peas and oats.

Block 7 was sown in what would have been a very important manurial experiment with soft turnips, but the turnip-beetle took practically 80 per cent. of the young plants, so that no information was forthcoming this year.

ROOT AND FORAGE CROPS MANURIAL TRIAL.

Information with regard to results of the manurial treatment of the various crops in Block 14 (10 acres) has been keenly sought. The results are interesting, and indicate that nitrogen is of economic importance in the case of crops like chou moellier, Thousand-headed kale, and cabbage. In the case of both turnips and swedes the weight of roots per acre was not influenced to any extent, although the top growth certainly was. In the case of Yellow Tankard turnips, Seychelles Islands phosphate, at 3 cwt. per acre, was tried against a complete manure, and proved superior in this test by over 2 tons per acre. In the swede area the addition of potash salts gave on the whole a better crop, and this was verified in the weighing.

The treatments per acre were as follows: (1.) Super, $1\frac{1}{2}$ cwt.; Nauru phosphate, 1 cwt. (2.) Super, $1\frac{1}{2}$ cwt.; 30-per-cent. potash, $\frac{3}{4}$ cwt.; Nauru phosphate, 1 cwt. (3.) Super, $1\frac{1}{2}$ cwt.; Nauru phosphate, 1 cwt.; 30-per-cent. potash, $\frac{3}{4}$ cwt.; blood, $\frac{1}{2}$ cwt.

The results of the weighing in each case were as follows, the manurial treatment being indicated by numbers as shown above:—

Superlative swede ..	(1) 35 tons ;	(2) 38.4 tons ;	(3) 36 tons ,
Chou moellier ..	(1) 26.8 „	(2) 28.6 „	(3) 34 „
Thousand-headed kale	(1) 15.6 „	(2) 19.5 „	(3) 27.2 „
Drumhead cabbage	(1) 14.9 „	(2) 16.0 „	(3) 21.3 „

Acknowledgment is due to Mr. T. N. Pattinson, Overseer of the Area, for the interest and care taken by him in carrying out the farm operations, which contributed greatly to the success of the undertaking.

(2.) Gore Area.

The Gore Area is now largely devoted to fertilizer tests and experiments for the purpose of overcoming diseases of turnips, swedes, and potatoes. Interim results in most cases have been highly satisfactory, but considerable time must elapse before all the experiments can reach finality. In the coming season work on the eradication of smut in oats by means of the hot-water treatment will also be undertaken.

A large number of farmers have visited the Area during the year, and the field-day held in February last was attended by over one hundred, notwithstanding wet weather.

DISEASES OF TURNIPS AND SWEDES.

Trial of Disease-resistant Turnip (Block 1).—The variety tested was Irvine's Green-top Yellow Disease-resistant, sown with a commercial Green-top Yellow turnip as a control. This block had carried a turnip crop in the preceding year. Seeding in the past season was at the rate of 1 lb per acre, and the crop was sown on 16th November. Twenty-four drills were manured with superphosphate at 2 cwt. per acre, plus 1 cwt. per acre of 30-per-cent. potash salts. The remainder of the area received super only, at 2 cwt. per acre. Irvine's Disease-resistant turnip showed a more robust growth than the commercial line throughout the growing-period, and the addition of potash gave a better growth than super alone. The turnips were weighed and examined on 11th May, with the following result:—

Variety.	Manurial Treatment.	Cost of Fertilizers per Acre.	Number of Turnips examined.	Number diseased.		Percentage of Infection.	Yield per Acre.
				Dry-rot.	Club-root.		
Irvine's Disease-resistant	2 cwt. super ..	s. d. 13 6	377	1	228	60.7	Tons. 15.77
Commercial ..	2 cwt. super ..	13 6	376	1	300	80.0	14.68
Irvine's Disease-resistant	2 cwt. super, 1 cwt. 30-per-cent. potash	21 0	345	Nil	245	71.0	18.49
Commercial ..	2 cwt. super, 1 cwt. 30-per-cent. potash	21 0	350	Nil	311	88.8	15.50

Disease-resistant Swedes.—Block 2 was used for a trial of disease-resistant swedes—Irvine's Disease-resistant Purple-top, Springwood, Wiboltt's Purple-top, and Studsgaard—with a purple-top commercial swede as a control.

A manurial trial was also worked into the experiment, the different manures being as follows: A—Superphosphate, 2 cwt. per acre. B—Super, 2 cwt.; 30-per-cent. potash, 1 cwt. per acre. C—Super, 2 cwt.; 30-per-cent. potash, 1 cwt.; dried blood, $\frac{1}{2}$ cwt. per acre. Throughout the experiment the turnips in the drills dressed with superphosphate alone were through the ground several days ahead of

the other treatments, and suffered rather severely from an attack of the turnip-beetle. Treatments B and C both showed a much better top growth, especially in the case of C. In weights per acre, however, the respective treatments did not show much difference in any one variety, except in the case of Studsgaard, where the complete manure gave a greatly increased yield.

As regards disease, Springwood Purple-top showed the greatest degree of infection and Studsgaard the least among the varieties claimed to be immune. The commercial line weighed up very well, but was practically all infected with club-root, while in Studsgaard the average infection was only 14.5 per cent.

Hot-water Treatment of Seed.—On part of Block 9 two small but very interesting areas of swedes were also accommodated. The block was in swedes last year, and the roots were very badly affected with dry-rot. Each area consisted of four drills 6 chains long. The same variety of seed was used throughout the experiment, but area A was sown with untreated seed, while that for area B was given the hot-water treatment by Mr. J. C. Neill, Field Mycologist, for control of dry-rot. Germination was quicker and better in the case of treated seed. All roots were examined on 14th May. In the case of area A many of the bulbs were in such an advanced state of decay that examination was difficult and in many cases impossible. The result of the examination was as follows:—

		Number of Roots examined.	Number showing Dry-rot.	Percentage of Infection.
Area A	..	.. 312	47	15.0
Area B	..	.. 610	1	0.1

OATS AND SCOTCH TARES FOR SEED (BLOCK 3).

This crop was sown on 9th November at the rate of 1 bushel of oats and 2 bushels of tares per acre, with 2 cwt. super, for the purpose of obtaining seed. The growth was exceptionally good, but a heavy storm in January caused the crop to lodge badly, and difficulty was experienced in harvesting. This block was rather badly infested with weeds, but is now in a clean condition, the growth of tares being so strong that all weeds were completely smothered.



CUTTING OATS AND TARES, GORE EXPERIMENTAL AREA.

OATS AND PEAS FOR HAY (BLOCK 4).

This crop was sown on 9th October with $1\frac{1}{2}$ bushels Crown oats and $1\frac{1}{2}$ bushels Partridge peas per acre; fertilizer used, basic super at 2 cwt. per acre. The oats came away well, but the grass-grub took a fairly heavy toll of the peas. The yield of hay was 2 tons per acre. In the adjoining block of oats and tares the grub was present, but no damage was done to the tares.

KALES.

Thousand-headed Kale (Block 6).—This crop was sown on 24th November, the fertilizer used being basic super at 2 cwt. per acre. The growth was very even throughout, and the crop yielded 15 tons per acre.

Chou Moellier Manurial Trial (Blocks 7 and 8).—This experiment created much interest. The growth in the case of the complete manure was very good, and the plants were of a darker colour. The crop was weighed on 11th May, with the following results: 2 cwt. basic super, 18.11 tons per acre; 2 cwt. super, 16.5 tons; 2 cwt. super, $\frac{1}{2}$ cwt. 30-per-cent. potash salts, and $\frac{1}{2}$ cwt. dried blood, 20 tons.

PASTURE LIMING AND TOP-DRESSING.

Pasture Block 8A, laid down in 1923, was an unsatisfactory area, and it was decided to lime and top-dress with superphosphate at the rate of 2 cwt. per acre. The treatment completely transformed the pasture from a poor open sward with considerable ingress of weeds to a very fine pasture which almost completely covered the soil, and with an abundance of white clover. This was a remarkable demonstration of what top-dressing can accomplish in the way of pasture-improvement.

POTATOES (BLOCK 8B).

Pure Seed.—An area of $1\frac{1}{4}$ acres was planted with Up-to-Date potatoes for the purpose of obtaining a pure line of seed for future use. A quantity of seed was procured in the open market. The variety was supposed to be Up-to-Date, but it proved an impure line, and when the growing crop was rogued about half the plants had to be removed. Other seed was procured at Gore and proved satisfactory. This line was rogued during growth, and the seed is now, as far as can be seen, absolutely pure.

Control of Corticium Disease.—Another part of this block was laid out in experimental treatments having for their object the control of corticium disease. The variety used was Arran Chief, obtained from a line grown on the Gore Area last year; the seed was very badly affected with corticium. The work was carried out under the direction of Mr. J. C. Neill. The treatment consisted of soaking the tubers in a mercuric chloride and hydrochloric-acid solution of various strengths and for varying periods of time. During April Mr. G. H. Cunningham, Mycologist, and Mr. Neill visited the area and made a detailed examination of the tubers from the various plots. Later the potatoes were subjected to a further examination. The various treatments, when weights of plots were compared, showed very encouraging results. For instance, in the treatment with mercuric chloride (1 c.c.), hydrochloric

acid (10 c.c.), and water (500 c.c.), 90 per cent. of the tubers by weight were absolutely free from the disease, while in the controls on either side only 1.6 per cent. were free. Further experiments will be undertaken next season.

MANGOLD MANURIAL AND VARIETY TRIAL (BLOCK 9).

For this test the seed was sown on 9th November, and the crop was weighed on 14th May. The varieties and weights per acre manured with (1) 2 cwt. superphosphate per acre, and (2) 2 cwt. super, 1 cwt. dried blood, and 1 cwt. 30-per-cent. potash salts, were as follows: Wiboltt's Diana Ovoid Giant—(1) 16.2 tons, (2) 23.1 tons; Wiboltt's Studstrop—(1) 15.3 tons, (2) 28.4 tons; Sutton's Long Red—(1) 22.7 tons, (2) 28.2 tons; Wiboltt's Taaroje—(1) 21.3 tons, (2) 31.1 tons per acre.

On the manurial side of the experiment, in all cases the complete manures easily outdistanced the superphosphate controls. The crop was somewhat late in being sown, otherwise the weights per acre would have been greater. The quality of all varieties was good.

CLOVER VARIETY TRIAL (BLOCK 9A).

This trial—laid down in December, 1923—has proved of special interest to many visitors. It is unfortunate that almost the whole block has been so severely attacked by grass-grub that both grass and clover plants have been practically destroyed. The varieties tested were Dutch white, English wild white, and New Zealand white. The Dutch white was the best in point of growth the first year, but disappeared altogether last winter. The wild white was thickening up wonderfully, and the New Zealand white was also making good headway, until attacked by the grub. There was more winter growth on the wild white than on the other plots. The wild white was also a smaller plant, with smaller and darker foliage, and was later in flowering than the other varieties. The New Zealand white was very similar in habit of growth, but was a larger plant in every way.

LUCERNE.

The stand of 1 acre (Block 1A) was dressed with $\frac{1}{2}$ ton of carbonate of lime during the winter. The growth this past season has been very good. Two hay crops were taken, and the third growth eaten off with sheep. The amount of hay obtained amounted to $1\frac{3}{4}$ tons, and the last growth was equal to $\frac{1}{2}$ ton, making a total of $2\frac{1}{4}$ tons hay per acre.

Acknowledgment is made of the good work done during the year by Mr. James Sleeman, Overseer of the Area, who has exercised the great care, patience, and exactitude required in operations of the kind here recorded.

Phosphate on grassland encourages clovers; clovers build up fertility; and fertility means increased grass-growth. Apart from increased yield, top-dressed grass increases in palatability.

HISTORY OF CHEWINGS FESCUE.

ADDITIONAL INFORMATION.

IN an article on Chewings fescue published in the *Journal* for December last the writer gave a brief account of the history of the plant in New Zealand. Since then two correspondents have forwarded additional particulars as to the original saving and commercializing of the seed. An Auckland correspondent writes:—

Chewings fescue was practically discovered by the late W. F. D. Rich, of Okoroire, manager of the Thames Valley Land Company, whose estates were on pumice soil which was then too light and loose to grow the cocksfoot and rye-grass then in vogue. When in Southland, and talking the matter over with other farmers, he was advised to see a new grass growing on loose soil on Mr. Chewings's farm. Mr. Rich was well taken with it, and wrote to England to find out what it was, and being told it was hard fescue he ordered several tons through Hesketh and Aitken, then seedsmen in Auckland. But this hard fescue was no more lasting than previous sowings, so he prevailed upon Mr. Chewings to save some of his particular grass. Not knowing what particular fescue it was, he called it "Chewings' fescue." He later wrote frequent articles in the Auckland papers recommending it for pumice soils. He tried too late to get the name changed to "Rich's fescue," and it was catalogued for a time as Rich's or Chewings' fescue . . . I am certain that Mr. Rich was the first to "discover" the grass, in the sense of talking, writing, and popularizing it, and getting it saved commercially . . .

The second correspondent, from Dunedin, states:—

The credit of first having introduced Chewings fescue as a mercantile commodity must be given to the late Mr. G. C. Tothill, of the firm of Tothill, Watson, and Co., who secured the first seed from Mr. Chewings, and expended considerable energy in getting the seed tried in various parts of New Zealand.

Apparently the efforts of both these gentlemen were directed towards establishing the grass throughout New Zealand as a pasture plant, and there is evidence that a fair amount of seed was used in sowing country that has later been shown to give better results with other species. While a certain amount is still used for this purpose, it must be admitted that the special value of the grass lies in its ability to produce lawn turf, and, further, that if it was not for this character the Chewings fescue seed-growing industry would be insignificant.

The credit of establishing the present-day industry should be given to the persons who first recognized the value of the grass as a lawn constituent, and to those who introduced it into North America and Great Britain.

—N. R. Foy, *Biological Laboratory, Wellington.*

Adequate feeding of the dairy cow is often neglected, with the result that the return for the food consumed falls below the cost of production and utilization. Inadequate feeding lowers the earning-value of the land.

When cows are in milk the amount of protein they require for efficient production is high. Pasture with abundance of clovers, lucerne, ensilage supplemented with linseed, chou moellier, and turnips contain due percentages of protein.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

OLD roughage will now be cleared up on the pastures, and spring top-dressing may be commenced during the coming month. In the milder districts there should be a prompt response to quick-acting phosphates. Pastures dressed early in the winter with a slow-acting fertilizer will receive a great fillip if given 1 cwt. of super per acre. Following top-dressing, well-established pastures should be heavily tripod and chain harrowed to scatter winter accumulations of droppings. Vigorous harrowing is next in importance to top-dressing.

Areas intended for hay or ensilage should be well cleaned up in the bottom, and odd bits of fencing-wire, large stones, &c., removed, otherwise valuable time may be lost during hay harvest repairing the mowers. Where the land is available, however—say, after turnips or mangolds—it is often preferable to grow a special crop for hay. Many good pastures are entirely altered and their composition spoiled by being closed for hay. The taller-growing grasses, such as cocksfoot, become very strong, much to the detriment of certain finer grasses, and sometimes the sward becomes very open afterwards, the entrance of weeds and inferior grasses being thereby assisted.

The feeding-out of roots and hay on pasture-paddocks should not be carried so far that pugging or opening of the sward ensues. Weed-invasion tends to follow in this case, and the great growth of Scotch thistle is often due to such treatment.

TILLAGE AND SPRING CROPPING.

Land which is intended for early cropping should be turned over as soon as the soil conditions are favourable. The sod will then be laid bare to the late winter frosts and mellowed to some extent. The early spring rains will also be better conserved, this factor being specially important where the land is intended for root crops. A frequent stirring with the tine harrows or cultivator is of great value in that early spring weed-growth is checked and more surface laid bare to the action of frost and sunshine.

Previously skimmed lea or other land should be ploughed a second time, either towards the end of August or early in September. The root crop suffers too often as a result of only one ploughing, and that late in the season. In a great many cases it would pay handsomely to halve the area, double the cultivation and manure, and intercultivate more thoroughly during the growing season. A poor-yielding mangold crop, for instance, is expensive to produce, but, unfortunately, provides the line of least resistance.

Where the autumn is usually dry and pasture-growth likely to suffer, the dairy-farmer especially should make ample provision of suitable spring-sown fodder, such as chou moellier, soft turnips, oats

and tares, millet, temporary pasture. In scheming out the work ahead it is a wise policy to overestimate the requirements of the stock and underestimate the yield of the crops.

Western Wolths and Italian rye-grass, about 15 lb. of each, with 5 lb. or 6 lb. of cow-grass per acre, sown late in August, makes a quickly grown and very useful temporary pasture, and can also be used later for hay or ensilage if necessary.

Oats and tares on the stronger types of soil, and oats and peas on lighter lands, can with advantage be sown during the latter part of August in milder districts. A dressing of 2 cwt. super or basic super should be applied with the seed, which is usually sown in the proportion of 2 bushels of oats to 1 bushel of peas or tares, per acre.

CEREALS.

Generally speaking, the end of August is quite early enough for sowing spring wheat. For wheat the seed-bed should be worked deeply. The cultivator does better than the disk, as it works the fine soil down and brings the clods to the surface. These afford shelter to the young plants and are later broken down by the roller. In order to make up for the lesser amount of tillering, a heavier seeding than with autumn-sown is required—about $2\frac{1}{2}$ bushels per acre being the usual amount. Superphosphate, from 1 cwt. to 2 cwt. per acre, sown with the seed, is a suitable manure generally.

Oat-sowing can follow sowing of wheat. Early barley may also be sown in August; Cape or Black Skinless will provide useful spring feed for stock. Barley has a weak-rooting system and requires a thorough tilth; the seed-bed should be light without being puffy. An average seeding is 2 bushels per acre, and 1 cwt. to 2 cwt. super per acre, according to conditions, may be recommended.

Spring-sown cereals in general are more susceptible to disease than those sown in autumn, and all seed wheat should be pickled to control smuts before sowing.

Where it is intended to carry on an autumn-sown cereal crop for grain, chaff, or hay, the final feeding should in most cases be done by the end of August, exceptions being very strong land where there is a danger of the crop growing too much to straw and lodging. In such situations feeding-off may often be profitably carried on till the end of September. After the final feeding the ground should be given one or two strokes of the tine harrows. This will open the land, scatter the stock-droppings, and greatly hasten subsequent growth. If the crop has not been previously manured and appears somewhat thin or weak, 1 cwt. of super per acre, applied before or during the harrowing, will greatly benefit it, and often mean the difference between a profitable crop and an unprofitable one.

LUCERNE.

Provided weather and soil conditions are favourable, lucerne stands should be well cultivated during August, before growth has commenced. A top-dressing of 2 cwt. super or basic super is advisable if best results are to be expected. In cases where sulphate of potash or 30-per-cent. potash salts have been added the lucerne has often

appeared more vigorous, with greater freedom from leaf-spot and root-fungus.

ARTICHOKES.

Artichokes are valuable as a food for pigs, and have a higher nutritive value than potatoes, but they are not without disadvantages, being often very difficult to entirely eradicate; hence it is wise to utilize odd corners of the farm or set aside a permanent area for the crop. There are two varieties of the Jerusalem artichoke in use—the purple-skinned and the white-skinned. There is little difference between them, but, if anything, the purple-skinned is more in favour. Artichokes thrive in land suited to potatoes—well drained, light, and friable; but fairly poor and gravelly soils are also suitable. The ground requires to be well worked, and deep winter ploughing is advantageous. Being frost-resistant, artichokes can be sown from about the middle of August or in September.

Like potatoes, artichokes are sown only by tubers, in sets about 2 ft. apart in the rows, which should be about 3 ft. apart, and at a depth of about 4 in. From 8 cwt. to 10 cwt. per acre are required, using medium-sized tubers. Large sets often produce so many stems that the crop becomes crowded and poor tubers result. On the other hand, if the seed is small the shoots are liable to be weak and spindly, resulting in a poor crop of small tubers.

The most satisfactory way to utilize artichokes is to allow pigs to forage them. The pigs should not be left on too long, otherwise the crop in the following season may not be as successful as desired. Pigs usually leave many small tubers in the ground, and these do not throw strong plants; but, even so, several successive crops can be grown. The ground should be manured each season, however. After stocking with pigs the only cultivation that is necessary is to replough and keep the surface-soil loose and free from weeds until the next growth of the crop is well above ground.

A general fertilizer as for potatoes is required, the amount used varying with the type of soil. The following mixture, applied at the rate of 5 cwt. per acre, is suitable: Super, 2 cwt.; kainit, 2 cwt.; blood-and-bone, 1 cwt. If any farmyard manure is available it should be utilized, and the mixture of artificials altered accordingly.

MISCELLANEOUS.

If feed is scarce it will pay dairy-farmers handsomely to supplement the ordinary grass ration of low-conditioned cows with some concentrate such as crushed oats or linseed-meal. Response to the spring flush of grass will then be prompt—not, as is often the case, several weeks later when the cows have rebuilt their condition. Plenty of salt should be at hand for milking-cows.

After heavy rains the outlets of mole or tile drains should be examined and any obstructions removed. Wet patches over known lines of under-drains may indicate a broken tile or other obstruction.

Among other wet-weather work, stored potatoes should be picked over, and all rotting or diseased tubers removed.

—*Fields Division.*

THE ORCHARD.

FINISH OF PRUNING.

PRUNING should now be pushed on with all possible despatch. Such a reminder is necessary, judging by the fact that it is not unusual to see pruning being done after trees have commenced to shoot. When this takes place it is a sure sign that the sap has commenced to circulate and nature is functioning throughout the tree; therefore any part of the tree removed after this time necessarily removes some of the sap-flow, and the tree receives a check which is detrimental to its growth. If it is not possible to finish all pruning before growth commences, endeavour should be made to get the trees of less vigorous growth and those that move the earliest completed first.

WET-DAY JOBS.

There are many days during the winter when it is not possible to prune, but there is usually no dearth of jobs requiring attention during the slacker part of the year. In view of the approach of the spraying season the spray-pump and engine should be taken down and thoroughly overhauled and cleaned. It is unwise to trust to luck that it will be all right for another season. The fruit-grader requires cleaning up also, and bearings and belts adjusted. Orchard picking-boxes need repairing and renailing, and the orchard implements cleaning and oiling. There is nothing more irritating, after deciding to get on with certain work, than to find that a day or so must be lost to get the necessary repairs effected.

SPRAYING OF STONE-FRUIT TREES.

The necessity of spraying stone-fruit trees with an insecticide must be determined by the condition of the trees. The common pests to be looked for are San Jose scale and red mite. Green aphid may have been prevalent during the preceding season, in which case spraying will be a preventive measure against attack in the coming season, as the eggs will be secreted round and under the bud scales. Red-oil emulsions, at a strength of 1-15, can be used before bud movement on stone-fruit trees, choosing bright sunny days for the work, as the oily mixture will then penetrate better into the cracks and bud scales and likewise smother the insect eggs better. One cannot expect eggs or insects to be destroyed if the spray does not reach them. In bad infestations of San Jose scale it is better to remove all limbs and twigs than trust to the insecticide, as it is almost impossible for even oil sprays to penetrate through the overlapping scales in excessively bad infections. Lime-sulphur may be used at 1-10 in lieu of oil. Some growers prefer to use this, depending on it to act both as an insecticide and fungicide. I favour the oil sprays, followed by bordeaux later, if these pests are to be successfully contended with.

CONTROL OF FUNGOID DISEASES.

As soon as the buds have a tendency to swell, bordeaux should be applied at 8-6-40. If delayed longer the spores of leaf-curl fungus and shothole become active, and the disease will then not be so easy

controlled. This mixture will also control the fungus causing bladder-plum and peach and plum rusts, and will also be of assistance against brown-rot infection. As an aid to the control of the latter all prunings should be picked up and destroyed, as well as mummified fruits that may still remain ungathered. Bordeaux, at 3-4-40, can be applied again at the first sign of pink if the trees are liable to bad attack.

PLOUGHING AND MANURING.

After a fine spell ploughing should be proceeded with where green crops are ready to be turned in. If it is proposed to use phosphatic manures such as basic slag, basic super, bonedust, or a dressing of lime, these can be spread prior to the ploughing. If put in at this time greater benefit to the trees will accrue than if left till later on, especially if the weather sets in dry. Effort should be made to dig round the trees prior to spring-time in order to bury all leaves and rubbish, remembering that black-spot infection largely comes from the fallen leaves.

REWORKING OF UNDESIRABLE VARIETIES.

It will now be obvious to growers that some of the older and more inferior varieties, especially the mid-season sorts, have had their day and will no longer stand transportation charges, &c., and leave a profit. It is difficult, however, to know what to substitute. It would appear to be unwise to work on any more Delicious; there are thousands of trees of this variety yet to come into full bearing. For export purposes Statesman promises well, being a free grower, good cropper, and producing a high percentage of fancy-grade fruit. Golden Delicious is being talked of a good deal, but from recent information gathered from a visitor from America this apple is very variable, according to the locality where grown, and very tender to handle. Thorough trials in each district would appear advisable before heavy reworkings are undertaken.

—J. H. Thorp, *Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Oranges—Poorman and sweet—may be harvested as ready. Preserving-oranges may be picked for market when showing very light yellow. Larger-sized Poormans, intended for use as dessert fruit, should be allowed to become well mature on the trees and attain a uniform deep-yellow colour. Sweet oranges will also be of better dessert quality if left to mature for some time on the trees after they become fully coloured. Lemons should also be picked—if for curing, when sufficient size is attained, though the fruits are of light green to silver colour; if as tree-ripe, when light yellow.

Planting: All kinds of citrus-trees may be planted at this season. The essential factors are: (1) The soil should be in good order at time of planting—that is, not sticky; (2) trees should be planted firmly, but the surface soil left loose; (3) the plants should be supported by a strong stake inclined towards the prevailing wind; (4) the stake (not tree) should be bound with sacking or like material to prevent chafe; (5) long extensions or unshapely growths should be cut back in order to shape the tree and restore balance between top and roots.

Where plantings are being made it will be advisable to plant a tree or so of the newly introduced lemon Meyer, to test as soon as possible its suitability to the location. This variety is extremely hardy and robust, and produces fruit of nice commercial size and of a very refined type. Freshly picked fruits have the appearance of well-cured specimens. Present indications are that this variety will be better worth growing than most others in localities to which it is suited.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE HATCHING SEASON.

IN a general way August and September are the best months of the year for the hatching of the late autumn and winter layers, though the former month is certainly the best time for chicks of the heavier breeds to be brought out. Chicks produced during this period will meet with those favourable conditions that are necessary for their best development. No young birds do so well as those which make their chief development as the days lengthen. Those hatched out in summer—which must necessarily make their main growth during the waning days—seldom grow to a desired size, nor prove profitable stock as egg-layers. Besides, they never make desirable breeding-specimens. Thus every endeavour should be made to secure the required number of young stock before the correct hatching season passes. To ensure best results in this important work (whether hens or artificial appliances are used) some experience is necessary. Even then failure is inevitable if constant attention to the numerous details involved is not strictly observed.

INCUBATION.

Those who have not had previous experience and are making their first attempt this season to work an incubator would be well advised to follow closely the instructions supplied by the maker. With experience, however, it may be found necessary to amend at least some of these to suit particular local conditions, as no hard-and-fast rule can be laid down that will suit all conditions alike. A few points on this important work, and which will apply generally to all machines, may assist the novice towards securing good hatches. Of course, the basis of successful hatching and rearing operations largely depends on the conditions of the breeding-birds. Unless these are vigorous, properly fed, and kept under conditions that will ensure the maintenance of good health, the best incubator or brooder ever made will fail to produce desirable stock.

Having eggs containing the desired strength of germ, the next important point is the maintenance of an even temperature in the incubator-chamber, about 102° F. for the first week, 103° for the second and third week, and 104° when hatching. By right degree of heat that should be maintained is meant the temperature required by the germ of the egg, which is always floating uppermost irrespective

of the position in which the egg is resting on the tray of the incubator. Thus the necessity of having the bulb of the thermometer resting on the top of a fertile egg will be seen. It is the position of the thermometer which is responsible for the success sometimes claimed by those who work at higher temperatures. For example, if the thermometer is 1 in. or more above the eggs, and therefore nearer the main source of heat, it must necessarily be registering at a different degree of heat from that which the eggs are receiving. For instance, if the bulb of the thermometer is from 1 in. to 1½ in. above the eggs, it would require to register 104° to 105° to make sure of the eggs having the desired temperature. Of course, an incorrect temperature may be secured by the reverse position—the thermometer being too far below the level of the top of the eggs. If the eggs commence to pip on the twentieth day and the hatch is cleaned up on the twenty-first day it may be taken for granted that the thermometer reads correctly, and that the right degree of temperature has been maintained. If the eggs are fresh when placed in the incubator and the thermometer kept on a level with the germs, and the hatch delays, it is well to have the thermometer tested or a new one secured.

Failure of the thermometer to register the correct degree of heat is a common cause of eggs failing to hatch on time and poor results being obtained from incubators. Of course, stale eggs will always take longer to hatch than those that are fresh, and allowance must be made for this. Eggs intended for incubation should be placed under the incubation process as soon after being laid as possible. True, they will often retain their hatching-qualities when a month old or even older, but usually the chicks produced from them are delicate and difficult to rear. Eggs for hatching purposes should also be frequently collected, especially during hot weather, as when several hens follow one another in the same nest the germ is apt to start in the first eggs laid and spoil their chance of hatching when placed in the incubator.

Reverting to the question of temperature, it is important for the incubator to stand on a solid foundation and be perfectly level, otherwise a uniform degree of heat will not be maintained in all parts of the egg-chamber. The incubator should also be placed in a room that is free from draughts, and the temperature of the room should not markedly fluctuate in accordance with outside climatic changes. Especially where a wooden room is used it is a wise course to have it well lined and arranged in such a way that extreme weather conditions may be guarded against. Care must be taken, however, that the room is well ventilated, as fresh air is imperative for best results. Ventilation should be arranged in such a way as to prevent the lamp being in a direct draught. The slightest flicker of the flame is apt to make the lamp smoke, which is a frequent cause of poor hatches and of incubators being destroyed by fire.

Bent connecting-rod: It is a mistake to throw tools, boxes, &c., on the top of an incubator when out of use, as this is apt to cause the screw part of the connecting-rod to become bent. If there is the slightest kink in the connecting-rod the pull from the thermostat will not be direct, and therefore the disk will not rise and fall in complete harmony with the thermostat. If the screw part of a connecting-rod becomes bent it can never be depended upon, and the only safe course

is to take it out and put a new one in its place. Much annoyance and loss through bent connecting-rods would be avoided if during the off season the regulating-apparatus were disconnected and placed inside the machine.

CHICKS DEAD IN SHELL.

The chief problem in incubation that is vexing poultry-keepers to-day is the finding of well-developed chickens dead in the shell at hatching-time. No definite cause can be attributed for this. The breeding-stock may be responsible—for instance, breeding from overfat hens that have insufficient exercise or birds that have been forced for heavy egg-production. Very often on close examination of such eggs there are many things to be observed indicating a probable reason for the failure to hatch. Sometimes the chicks are in such a position that it would be impossible for them to make the natural turn in order to cut their way out, while in other cases they may be so large that they cannot make the necessary movements. Further, it may be found that the air-cell is dried down too far, and that the membrane under the shell is so tough that the chick cannot pierce it, and consequently dies in the shell. In the work of incubation the aim should be to have the air-cell almost one-fourth the size of the egg at pipping-time—in other words, dried down to where a chick would be expected to pip when under natural conditions. Thus the size of the air-cell should govern to a great extent the amount of cooling, ventilation, and moisture required by the eggs during the various stages of the incubation process.

Where it is found that the air-cell is drying down too fast, moisture should be applied to check this, either by putting water in the trays provided or by keeping the floor of the incubator-room in a moist or more or less wet condition. Besides this, the ventilation-space should be reduced. On the other hand, if the air-cell is not coming down to a desired line at, say, about the fourteenth day, and the eggs appear to be more or less clear just under the line of the air-cell, the presence of excessive moisture is usually indicated. In this case the ventilators should be opened wide to allow the moisture to escape. If the cell is considered to be too small, and the egg appears to be dark right up to the membrane enclosing the air-cell, it indicates that the chick is growing too fast, and, if not checked, will be too large at pipping-time to enable it to turn in the shell and get out of its prison. This is probably why the remark is so often heard that the chicks which are found dead in the shell are usually of exceptional size when the eggs are broken. Where it is found that the chick is making too rapid growth the only safe course is to reduce the amount of ventilation and cooling, in order to prevent the developing chick from obtaining too much oxygen and thereby growing to an unnatural size.

Study of the air-cell is thus a matter of vital importance, for upon the operator knowing how and when to apply moisture, cooling, and ventilation depends largely the success or otherwise of the incubator work. The importance will thus be seen of carefully studying the diagrams shown in the usual book of instructions supplied by the makers of incubators as indicating what the condition of the air-cell should be at the various stages of the incubation period.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

PREPARATIONS FOR THE NEW SEASON.

By the end of August the beekeeper should have his preparations for the season's work well in hand. Hive and frame making, also the overhaul of all defective supers, roofs, and bottom-boards, should be undertaken in earnest. It is not wise to postpone the mechanical part of the work in the apiary until the bees themselves require the major portion of one's time. If increase is desirable—more especially where the apiary is being enlarged—ample provision should be made for it. It is most tantalizing to leave a swarm hanging on a tree while a hive has to be hastily put together.

Where the beekeeper does not make his own hives he should now order in sufficient stocks to see him through the coming season. In most cases it does not pay to make one's own appliances. Hive-manufacturing in New Zealand has been brought to a high standard, and unless the beekeeper has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on these lines. Non-fitting supers and frames mean extra labour, and lead to endless trouble in the long-run. The hives principally in use in the Dominion are the ten- and twelve-frame Langstroth, and experience of his district will enable the beekeeper to decide as to the best one to adopt. Careful inquiries should be made from beekeepers of long standing in the district as to the best style to use.

A CHEAP FRAME HIVE.

Though there may not be much gained in the long-run by making any other than good substantial hives in the first place (especially by those who can construct their own), there may be those to whom the question of saving a shilling or two upon each hive is a consideration. In such cases the following directions for converting a benzine-case into a frame hive of the same dimensions as the standard Langstroth, and which complies with the Apiaries Act, should be of service:—

Procure a complete and sound case and carefully take it to pieces, then rabbet the ends on one edge to a depth of $\frac{7}{8}$ in. by $\frac{1}{2}$ in. to carry the frames. A tin rabbet should be nailed on the inside, to stand $\frac{1}{4}$ in. above, on which the frames will rest. Now cut the sides so that they measure 20 in. Nail together, and this will give a hive the inside dimensions of which are $18\frac{1}{4}$ in. by $14\frac{1}{4}$ in. by $9\frac{5}{8}$ in. A loose bottom-board may be constructed 24 in. by 15 in. wide. Nail on the board three strips of wood, $\frac{3}{8}$ in. by 1 in., running along two sides and one end, so that when the hive is rested on the bottom-board it will leave an entrance $\frac{3}{8}$ in. deep. Top or surplus boxes can be made in the same way. The best roof to use is a flat one. It may be made from the surplus timber of the benzine-case, and should telescope to a depth of 3 in. over the hive. Cover the top with ruberoid, zinc, or other waterproof material, and let it overlap the edges.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

TOBACCO.

As the tobacco-plant takes about ten weeks to reach a size suitable for planting out in the field, a commencement is made during the month of August to sow down the seed-beds. The extreme fineness of the seed makes it necessary to distribute a small bulk over a comparatively large area. To do this conveniently one of two methods is adopted. Either the seed is mixed with a quantity of sifted wood-ashes, sand, or bone-meal at the rate of $\frac{1}{4}$ oz. of tobacco-seed to 2 quarts of ashes, and then carefully broadcasted, or it is placed in a can of water, kept carefully agitated, and sprayed on the seed-beds through a fine rose. Seed so fine requires little or no covering of soil: it is merely rolled in with a heavy hand-roller, or pressed in with a board, or trodden in with the feet. After sowing it is often watered in with a can with a fine-rose nozzle.

With a view to gaining a week or two on the season in colder districts some growers sprout the seed before sowing. This is done by sprinkling the seeds on wet flannels and rolling them up. These are immersed daily in hot water and wrung out and kept in a warm place. In about a week a small white shoot appears, and the seed must then be sown. Usually the advantage is hardly worth the trouble.

To provide against the danger of cold snaps and late frost a wooden kerb about 6 in. high is placed round the seed-beds, which are then covered with a hessian cover on a roller. This assists germination by keeping the bed warm and moist. To prevent the canvas touching the bed, stretcher-battens are nailed across the frame at intervals. In colder districts the beds are often made about 4 ft. wide and the frames covered with glass sashes until the plants have made sufficient growth, when they are removed and the cloth used. When the plants are up, air may be given on warm days, at first for short periods only.

Every agricultural product has its own requirements in the way of storage conditions, a careful observation of which well repays the owner. A fair quantity of tobacco-leaf is air-cured successfully in more or less open sheds, but to leave it there after curing, when it is exposed to cold draughts and humid conditions of the winter months, is to seriously discount its value. Tobacco should be stored in a dry, well-ventilated room of a temperature of 50° to 60° F. Unlined corrugated iron on which moisture deposits in cold weather is unsuitable in a building for this purpose.

SMALL-FRUITS.

The planting of berry-fruits should now be completed, pruning the plants hard back with a careful regard in most instances to the arrangement of the new growth of the coming season. Exceptions to this are passion-fruits, the planting of which is best held over till next month; also Cape gooseberries, tomatoes, and peppers, which are not planted out till all chance of a hard frost is past. Most established plantations of berries will benefit from an application of nitrate of soda, 1 oz. to the square yard or $2\frac{1}{2}$ cwt. to the acre, as soon as fruit commences to set. Clean up strawberry-beds that are to be grown on,

giving them a good spraying with bordeaux, 4-4-40, for the control of leaf-spot and other fungous troubles. Give a good dressing of phosphates and potash, and light cultivation. At this season it is specially necessary to call attention again to that old warning against working land when it is in a wet condition. The results are most serious, and cannot be overcome for a long period.

TOMATOES AND CUCUMBERS UNDER GLASS.

The main tomato crop under glass is usually planted out towards the end of August. In preparation a dressing of superphosphate and sulphate of potash may be given; lime, sulphur, and sulphate of iron are also sometimes added. The latter is a remedy for that yellow abnormal foliage known as chlorosis, which is getting rather too common a trouble. For planting, the soil is best in a firm condition. Houses that have been kept too close and allowed to become very dry should be thoroughly soaked before planting. Plant firmly in furrows of moderate depth and rather wide, watering the plants in. Many plants are seriously chilled in carrying out this operation; as an early and ample crop is the object, every care should be taken to avoid this. Avoid taking the plants into the open air as far as possible, especially in cold weather, and avoid the use of very cold water. Much has been said about the benefits of ample ventilation of the tomato-house, but such remarks apply chiefly to the period when the plants have grown up and during the summer season. At this season a little top ventilation can be given on bright, warm days until near the middle of the afternoon.

About the same time cucumbers are usually planted out in specially designed glasshouses, and to obtain the warm, moist conditions they require hot-water pipes, or a hot-bed of fermenting materials may be used. In the latter case much will depend on its preparation. It must be turned and mixed about three times, in each case after a high temperature through fermentation has been obtained, each time damping down with water any portions that are dry. It may then be placed in position and watered. Cover the bed with a suitable compost, arranging it in mounds, and when thoroughly warmed through the plants may be put out or seeds sown. The night temperature should not fall below 65° F., and on bright, warm days a little top ventilation may be given until the early afternoon.

OUTDOOR VEGETABLES.

Rhubarb and asparagus beds should now be given a dressing of nitrate of soda, the latter crop receiving a double dose of 5 cwt. per acre.

Plant out main-crop cauliflower and cabbage, lettuce and onion plants, shallots, garlic, artichokes, and early potatoes, and sow the main onion crop (where this method is adopted), spinach, and lettuce (as recommended last month) where this has not already been done.

To this list may now be added the main crop of peas. This crop, with the French beans to be sown later, is an important factor in a satisfactory crop-rotation, and should be given careful consideration

in that respect. They usually follow the root crops, and when well grown are of great assistance in reconditioning the land. Sow also the main crop of parsnips, short-horn carrots, turnip-rooted beet, white turnips, parsley, and cauliflower. A dressing of superphosphate and sulphate of potash before sowing would be good practice in most instances.

POTATOES AND KUMARAS.

The main-crop seed potatoes are usually too bulky to sprout in trays as the early varieties are often treated, but care is needed now to see they do not sprout in the sacks. They should be kept in a light sunny place and turned occasionally; also piling of the sacks refrained from.

In many parts of the Dominion main-crop potatoes often suffer badly from blights, and there is considerable interest being taken in the sweet potato, or Maori kumara, which is comparatively free from such troubles. Growers who have a moist, loose soil in a sheltered locality might well give this crop a trial. To obtain plants a hot-bed of 1 ft. or so in height should be formed in a warm, sheltered place during the month of August, and on it a board frame placed in position. Cover the enclosed portion with 2 in. or 3 in. of sandy soil. When it has become thoroughly warm, place on it the tubers close together, but not touching. Sift in the sandy soil and cover the tubers to a depth of 4 in. or 5 in. Keep the bed moist, but not wet, and in frosty weather cover with a good hessian cloth. In a few weeks the tubers will sprout, and when the growth is about 6 in. long the sprouts should be carefully removed and heeled in a sheltered place to callous and harden off before putting them out into a permanent position. Varieties that have done well here are Red and White Bermuda, Porto Rico, Nancy Hall, and Southern Queen.

TREES AND SHRUBS.

The planting of trees and shrubs should now be completed as soon as weather and the condition of the soil permit, care being taken to securely fence them from the reach of stock. Many shelter plantations are foul with gorse, bracken, and dead timber. The destruction caused by fire in recent years is a serious warning that such conditions should not be allowed to continue. If this rubbish is cleaned up and piled in the open and burnt, and the ashes spread, the danger will be averted and the land will benefit.

GRASS-GRUB IN PLAYING-GREENS.

Inquiries have been received regarding damage to playing-greens from the attacks of the grass-grub. On light land in dry weather this pest is often a serious problem. Methods will doubtless be discovered of destroying the pest on small areas by means of fumigation, but up to the present little success has been achieved in this way. Lawns on such land would receive great benefit from frequent rolling when it is in a moist condition. They should also be given now a generous top-dressing of soil and manures to encourage a strong growth of turf.

—W. C. Hyde, *Horticulturist*.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COUGHING AMONG SHEEP.

"R.," Bay of Islands :—

For the last two years I have noticed several of my stud sheep coughing at this season. It cannot be caused by cold, as they commence during the autumn while the weather is quite warm. Is it likely to cause rupture, and can you suggest a cure or preventive? The coughing leaves them in the spring without having pulled them down in condition.

The Live-stock Division :—

The coughing is not likely to cause rupture. The cause of the coughing is probably the common lung-worm, which sets up an irritating bronchitis. Feeding on low-lying or wet pastures is a contributory cause of the parasitic infestation, because such areas are conducive to the life and propagation of these worms. Good well-drained paddocks should be provided for sheep if they are inclined to harbour parasites, also a daily ration of nutritious food, such as crushed oats and good hay. For the sheep which are severely affected a drench of two teaspoonfuls of turpentine (for lambs, one teaspoonful) given in a large cup of milk two or three times at intervals of two or three days is recommended.

GRASSES FOR SWAMP AREA.

I. B. CRUICKSHANK, Otewa :—

I should be obliged if you would tell me if it is possible to procure in New Zealand plants of *Poa aquatica*. Do you think it advisable to plant it in a small raupo swamp for grazing dairy cows?

The Fields Division :—

Poa aquatica is a decidedly inferior grass, being coarse and unpalatable. However, it makes very fair rough feed which stock will make use of in seasons of scarcity. Plants may be obtained from most seedsmen. A far better grass is *Glyceria fluitans* (floating sweet-grass), but apparently there are no regular supplies of this. It might be possible for you to obtain plants locally. Without knowing the possibilities of your swamp it is difficult to advise you further. Presumably it is too wet to grow such plants as alsike, clover, *Lotus major*, Yorkshire fog, and timothy. These are very much better feed than *Poa aquatica*.

FEEDING MANGOLDS TO POULTRY.

"INTERESTED," Upper Hutt :—

Kindly advise me whether mangolds for feeding to poultry may with advantage be fed directly when pulled, or whether they should be pitted to allow for them ripening, as is recommended when feeding to cattle?

The Live-stock Division :—

It is always a wise course to pit mangolds for some time before feeding them to poultry. Especially does this apply to districts that are subject to heavy frosts.

MELONS FOR PIG-FOOD.

"SUBSCRIBER," Dargaville :—

Could you kindly advise me of the value of pie-melons for pig-food during winter, and also whether to feed them boiled or raw?

The Live-stock Division :—

Pie-melons and other gourds of a similar nature all make good pig-food, but are not sufficient in themselves owing to their low feed value, and should be supplemented during the winter months by grains or meals. Foods of a more nourishing nature, such as artichokes or chou moellier, can be more readily grown and have a much higher feed value. There is no need to cook the melons; they are best fed raw.

NON-FRUITING OF CHERRY-TREES.

G. J. DUXFIELD, Matamata :—

I have two cherry-trees that blossom every year but do not fruit. The fruit forms, but drops off when about the size of peas. The trees have been planted about fifteen years. Can you recommend any treatment?

The Horticulture Division :—

The reason for your cherry-trees not setting fruit may be any one of a number of causes, such as disease, wrong cultural methods, frosts, unsuitable weather at the time of flowering, general debility, or (perhaps what is most likely) want of interpollination with another variety. The practice of planting blocks of trees of one variety has revealed the fact that many kinds and varieties will not set a crop unless associated with other varieties which flower at the same period. The point could be tested by obtaining cherry-blossom of another variety and placing it in a tin of water beside your trees when they are in bloom.

GRASSES FOR BAY OF PLENTY SANDY COASTAL LAND.

F.W.N., Thornton :—

I have poor, sandy, coastal land—ploughable, but only suitable for sheep and dry cattle. I expect to be sowing some down to grass this coming spring, and was thinking of including some tall fescue in the mixture. To give you an indication of what class of land it is, the main grasses will be brown-top, paspalum, *Danthonia pilosa*, and some crested dogtail, with clover. Any advice regarding the fescue will be appreciated.

The Fields Division :—³

From knowledge of your district we would advise you not to grow tall fescue on the sandy coastal land. As you intend sowing in the spring your best plan would be to aim at a paspalum-clover pasture. We would advise a mixture somewhat as follows: Perennial rye-grass, 8 lb.; Italian rye-grass, 3 lb.; paspalum (at least 40 per cent. germination), 12 lb. to 14 lb.; brown-top, $\frac{1}{2}$ lb.; crested dogtail, 2 lb.; white clover, 2 lb.; red clover, 3 lb. Sow the mixture with 2 cwt. of superphosphate and 1 cwt. of blood-and-bone per acre.

MAINTENANCE OF BREEDING-SOWS.

J. BREMNER, Kokako :—

Next season I am contemplating the keeping of several breeding-sows in conjunction with the dairy herd, from which I expect to have left over, from September to March, 40 gallons of skim-milk daily. Towards the end of the season the milk would be supplemented and afterwards replaced by artichokes, pumpkins, &c. Providing the sows are allowed free access to water and good paspalum pasture, and that the litters are sold as weaners, how many sows should I keep—all farrowing during August and September? Would you recommend feeding to them the boiled-down carcasses of calves?

The Live-stock Division :—

If you make provision for plenty of winter and early spring feed, such as artichokes, rape, mangolds, and chou moellier, you should be able to maintain

ten breeding-sows throughout the year under the system you suggest. You can use to advantage the meat and liquid from boiled calves, but the sows should not get too much, especially when the young pigs are suckling, as the meat is of a highly nitrogenous nature and can easily upset the sow. On this account the young pigs will suffer too. It is advisable when giving food of this nature to add some grains or meals so as to balance the ration.

IRISH BLIGHT IN STORED POTATOES.

“POTATO-DIGGER,” Ashburton :—

Can you tell me (1) if there is any method of detecting Irish blight in potatoes; (2) whether if blighted potatoes are stored with clean ones the blight will spread to them also; (3) if there is any method of killing the blight at this stage in potatoes that are going to be used for seed?

The Fields Division :—

Irish blight may be detected in potato-tubers by the appearance of small depressed areas in the skin, accompanied by discoloured patches in the flesh beneath the depressions. These discoloured areas, as a rule, do not penetrate deeper than $\frac{1}{4}$ in. to $\frac{1}{2}$ in., but in severe cases of infection the greater part of the tuber may be infected. Severe infection is usually followed by decay of the tuber. The disease may spread from diseased to healthy tubers, especially when stored under moist conditions. There is no method in use whereby the disease may be destroyed without injury to the tuber. We recommend greening of tubers prior to planting, as the diseased tubers become noticeable and may be removed. By careful selection it is possible to eliminate most if not all diseased tubers in a lot required for seed.

FOOT-ROT IN BULL.

“LUCERNE,” Waharoa :—

I have a pedigree bull that has had what is commonly called foot-rot—swelling and discharge between the two parts of the foot. I washed it daily with lysol and hot water, and applied Stockholm tar. The foot healed up, and the swelling was reduced, but there is still slight swelling and lameness. Can you suggest a complete cure?

The Live-stock Division :—

The treatment you adopted was quite a good one, and it has been successful in healing the wound. Some time may now elapse before all lameness and swelling disappear—indeed, such is quite the course to be expected. In order to reduce these two troubles we would advise applying a blister to the swollen part around the head of the hoof, taking care that a slough is not caused in the heel where the skin is thin. This treatment may be repeated, if necessary, two or three times. Undoubtedly, the underlying tissues of the foot have been detrimentally affected, and will need time to become restored to the normal.

BLUESTONE AND MUSTARD DRENCH FOR SHEEP.

J. C. SCHENCK, Ormondville :—

Can you give me the formula for bluestone and mustard for dosing lambs and sheep—quantity and strength in each case?

The Live-stock Division :—

For this, drench 2 oz. of bluestone is dissolved in 1 gallon of water. Of this solution the dose for a sheep is 3 oz., and half that quantity is the dose for a lamb. It is doubtful if the addition of mustard has any beneficial effect, but it can be added in the same quantity as the bluestone.

SOME AGRICULTURE DEPARTMENT EXHIBITS AT NEW ZEALAND AND SOUTH SEAS EXHIBITION,
DUNEDIN, 1925-26.



WOOL AND WOOL TEXTILE EXHIBIT.



BIOLOGICAL LABORATORY EXHIBIT.

[Photos by H. Drake.

WEATHER RECORDS: JUNE, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

RAINFALL in June was below the average in most parts of the Dominion, but northward of Auckland and Thames it was from 10 to 58 per cent. above the average. In the South Island the records from Hanmer Springs, Arthur's Pass, and Queenstown show total rainfalls above the average for the month in previous years; all other places record a deficiency from 10 to 80 per cent.

There were two ex-tropical disturbances, with their lowest pressures passing on the 3rd and 30th, which accounted for heavy rainfall in the far North. An intense westerly disturbance passing between the 11th and 16th brought high north-westerly to south-westerly winds and squally conditions, particularly in and southward of Cook Strait. At this time also there was some snow on the higher levels in the South Island and southern parts of the North Island. Otago and Southland, however, escaped storm effects, and the weather in these districts was, as frequently occurs there in winter, remarkable for its mildness. Local observers report that grass showed signs of growth, and that there was also a second growth of turnips, which was very welcome to the farmers.

Barometric pressure was above normal, particularly between the 16th and 27th, when anticyclonic conditions ruled over the whole Dominion, with bright sunny days and frosty nights. Temperatures on the grass went below 32° F. (freezing-point) on thirteen nights at Hokitika, fifteen at Napier and Wellington, twenty-four at Masterton and Nelson, and twenty-six at Christchurch. ("Ground frosts" are counted below 30° F.) The range of temperature over the Dominion was rather larger than usual, and the weather, on the whole, cool and fair, with little wind.

RAINFALL FOR JUNE, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitaia	5.94	15	0.98	5.53
Russell	8.14	13	2.72	6.28
Whangarei	8.83	14	5.12	5.26
Auckland	5.42	15	1.44	4.91
Hamilton	4.43	16	1.08	5.07
Kawhia	3.32	14	0.92	5.46
New Plymouth	3.08	15	1.06	6.20
Riversdale, Inglewood	5.67	12	2.16	10.31
Whangamomona	4.97	8	1.40	7.92
Tairua, Thames	8.14	13	2.14	6.95
Tauranga	3.58	10	0.93	5.42
Maraekaho Station, Opotiki	5.82	11	2.58	5.68
Gisborne	2.07	14	0.56	5.28
Taupo	3.47	6	0.87	4.35
Napier	0.94	12	0.17	3.59
Maraekakaho Station, Hastings	0.69	14	0.18	3.33
Taihape	1.58	10	0.46	3.85
Masterton	1.46	13	0.46	3.48
Patea	1.85	12	0.50	4.40
Wanganui	1.42	3	1.00	3.29
Foxton	2.76	10	0.88	2.83
Wellington	2.86	12	0.87	4.90
<i>South Island.</i>				
Westport	3.69	11	0.75	7.53
Greymouth	5.27	11	1.39	8.99
Hokitika	7.44	12	1.73	9.60
Ross	5.87	7	1.11	9.20

RAINFALL FOR JUNE, 1926—continued.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
<i>South Island—continued.</i>				
	Inches.		Inches.	Inches.
Arthur's Pass	10.71	9	5.02	9.77
Okuru, Westland	8.76	9	2.75	10.76
Collingwood	8.59	10	3.16	11.33
Nelson	1.96	7	0.78	3.69
Spring Creek, Blenheim	1.19	6	0.45	3.23
Tophouse	4.39	9	0.85	4.99
Hammer Springs	4.20	15	1.10	3.05
Highfield, Waiau	1.59	8	0.47	2.50
Gore Bay	0.59	5	0.33	2.30
Christchurch	0.90	10	0.34	2.66
Timaru	1.10	7	0.58	1.70
Lambrook Station, Fairlie	1.52	7	0.50	2.06
Benmore Station, Clearburn	1.86	10	1.10	2.06
Oamaru	1.26	9	0.42	2.01
Queenstown	3.06	8	1.16	2.41
Clyde	0.62	6	0.26	0.98
Dunedin	2.83	14	1.10	3.15
Wendon	1.61	10	0.60	2.71
Gore	2.08	14	0.79	2.95
Invercargil, ...	3.23	18	1.20	3.60
Puyssegur Point	5.82	20	1.28	6.58

—D. C. Bates, Director.

DAIRY FACTORIES IN NEW ZEALAND, 1926.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1926, and the numbers of milk or cream suppliers to the factories:—

District.	Number of Factories.				Forwarded for Export, 1925-26.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
Auckland ..	65	35	6	106	Tons. 37,947	Tons. 10,785	16,417	1,255
Taranaki ..	20	73	37	130	7,736	31,953	3,150	3,397
Wellington ..	18	51	10	79	6,931	11,852	4,551	1,671
Hawke's Bay ..	14	16	3	33	2,629	3,146	3,775	554
Nelson ..	6	4	1	11	1,052	499	1,144	444
Marlborough ..	4	2	4	10	676	718	769	212
Westland ..	9	..	1	10	487	73	709	32
Canterbury ..	9	12	5	26	1,933	1,589	4,816	2,393
Otago and Southland	14	78	1	93	1,804	11,067	6,552	2,764
Totals, 1926 ..	159	271	68	498	61,195	71,682	41,883	12,722
Totals, 1925 ..	156	267	69	492	71,063	72,016	43,323	11,801

In the 1925-26 period there were also operating in the Dominion four milk-powder factories (one whole-milk and three skim-milk plants), four casein-factories, one condensed-milk factory, and one sugar-of-milk factory.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 6th May to 1st July, 1926, include the following of agricultural interest:—

No. 54093: Process for ascertaining fat-content of milk and cream; Hoyberg Company, Copenhagen, Denmark. No. 54457: Plough-lifting mechanism; W. M. Murray, Clydevale. No. 54534: Hedge-cutting machine; J. Johnston, jun., Invercargill. No. 54639: Wire-strainer; W. D. Nolan, Okuru. No. 55319: Cattle-mark; J. W. N. Gerritsen, Zeist, Holland. No. 56075: Plough-raising means; H. G. Cross, Christchurch. No. 56186: Milk pasteurizing and cooling; R. Wildridge, Sydney, N.S.W. No. 56203: Cream-can-emptying means; E. D. Berry, Palmerston North. No. 53926: Cheese-manufacture; I. Clark, Tisbury. No. 53942: Stack-cover; N. Ham, Orini. No. 55606: Seed-hulling machine; F. S. Hill, Cobden, Victoria. No. 53872: Cheese-press; R. Wyeth, Otautau. No. 54742: Plough-lifting and depth-regulating; J. McRae, Springburn. No. 54764: Weed-destroying method; H. Newrick, Wanganui. No. 56277: Milk-agitator; Dunn Bros., Ltd., Gore. No. 56382: Cattle-food; N. K. A. Albrektsson, Limhamn, Sweden. No. 55171: Butter-table; H. Ashworth, Wellington. No. 56411: Milking-machine releaser; C. A. Martin, Hamilton. No. 56477: Sheep-shearing machine; W. S. Whitcomb, Denver, U.S.A.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, Price 1s.

STOCK SLAUGHTERED, 1925-26.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1926:—

Stock.	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals
Cattle ..	157,668	206,904	..	93,259	457,831
Calves ..	43,242	31,358	..	2,670	77,270
Sheep ..	512,515	2,292,257	..	221,355	3,026,127
Lambs ..	85,198	5,055,245	..	20,498	5,160,941
Swine ..	127,216	159,852	42,922	28,349	358,339

INTERIM RETURN OF SHEEP AT 30th APRIL, 1926.

District.	Number of Sheep.		Difference.
	Final Return, 1925.	Interim Return, 1926.	
Auckland	2,092,244	2,225,878	+ 133,634
Gisborne - Hawke's Bay ..	6,344,990	6,210,877	- 134,113
Wellington - West Coast ..	5,282,307	5,347,909	+ 65,602
North Island totals ..	13,719,541	13,784,664	+ 65,123
Marlborough-Nelson-Westland ..	1,351,889	1,303,003	- 48,886
Canterbury-Kaikoura	4,984,062	4,912,152	- 71,910
Otago	4,492,463	4,748,029	+ 255,566
South Island totals ..	10,828,414	10,963,184	+ 134,770
Dominion totals ..	24,547,955	24,747,848	+ 199,893